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THE EXCAVATION OF SITES R11/887, R11/888 AND R11/899, TAMAKI, AUCKLAND

RUSSELL FOSTER AND BRENDA SEWELL

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Abstract. The excavation of adjacent sites R11/887, 888 and 899 in Tamaki are described. Together the sites formed part of an extensive open settlement occupied in the sixteenth century. The rescue nature of the excavations provided a valuable opportunity to examine a greater area of an open settlement than is usually possible. Specific activities were identified at R11/887, including cooking, living, storage and stoneworking areas. Site R11/888 has been interpreted as a specialist site with huts for storage of equipment and a living floor of laid shells. At R11/899 there were several superimposed houses and a group of deep storage pits. The layout of the sites presented an impressive illustration of an unfortified hamlet, probably associated with occupation of the pa at Te Apunga o Tainui.

A number of sites close to the Tamaki River have been interpreted as open settlements. Sullivan (1981:11) suggested that the lava fields between Te Apunga o Tainui and the river contained gardens, storage pits, temporary shelters and possibly house sites. Excavations of open settlement sites in this area have taken place at Hamlins Hill (R11/142, Davidson 1970a, Irwin 1975, Pearce 1975, 1977, Walton 1979, Nichol 1980a), Westfield (R11/898, Furey 1983, 1986) and Hawkins Hill (R11/1394, Coates 1986). The location of these sites and those reported here are shown in Fig.1.

Excavation of these three sites was carried out in 1985 as part of a research programme concentrating on settlement along the banks of the Tamaki River. They were adjacent to Fisher Road (now Carbine Road) 600 m to the west of the river and 800 m to the north-east of the former cone pa of Te Apunga o Tainui (McLennan Hills). The portable artefacts from these excavations are held in the Auckland Institute and Museum under accession number AR 7642. A full report of the excavations is presented in Foster & Sewell (1988).

THE LANDSCAPE

The Fisher Road sites were situated on the main lava flow running north-east from Te Apunga o Tainui. Topographically the area presented a rough and broken landscape, consisting of a number of low basaltic ridges partially covered by, and surrounded by, layered tuff which is likely to have come from the Otahuhu volcanic centre (L. Kermode, pers. comm. 1985). The soils were brown volcanic loams.

Charcoal and landsnail identification suggests that at the time of occupation the three sites were located in pockets of open scrubby vegetation surrounded by broadleaf/podocarp forest.

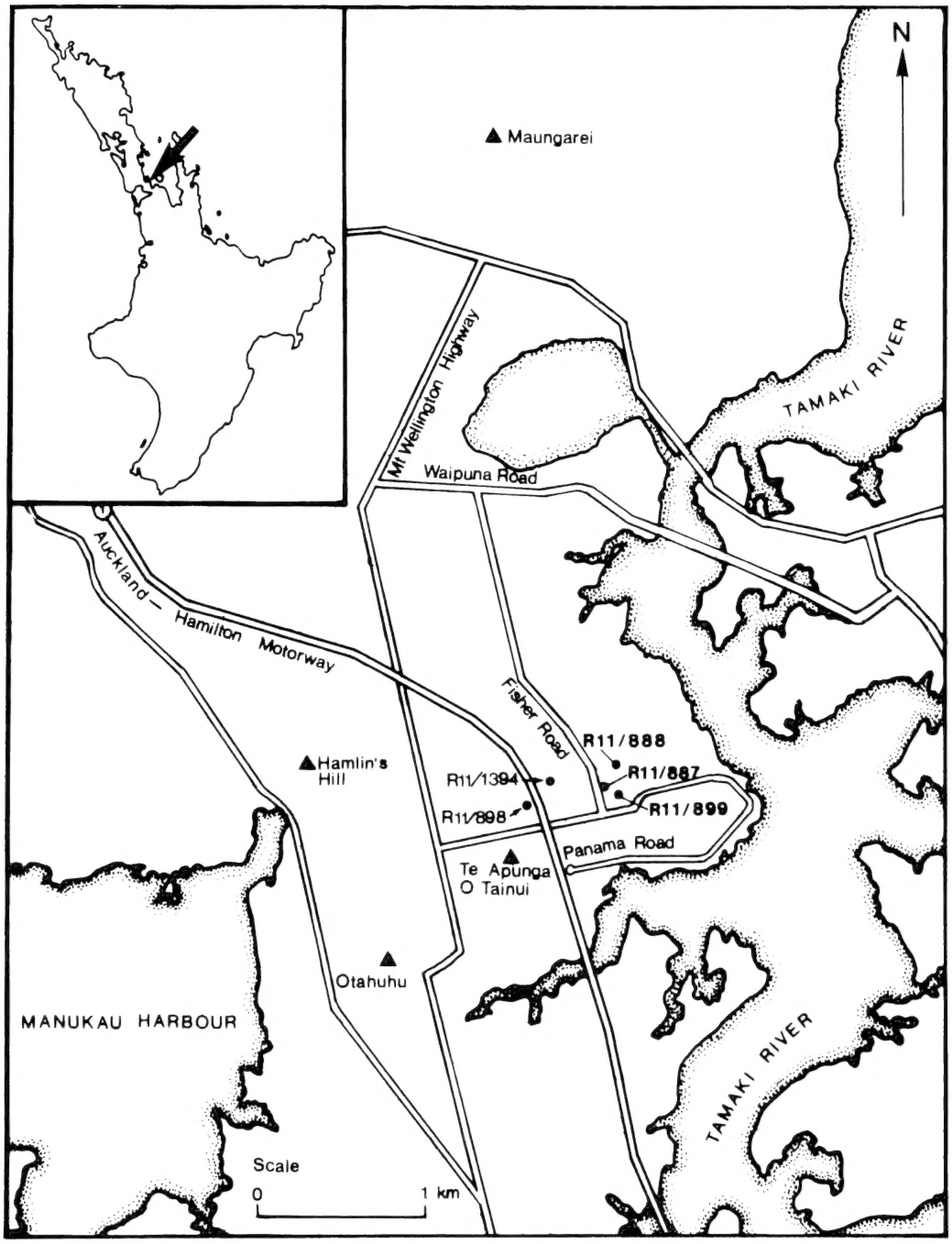


Fig. 1. Location of sites R11/887, 888 and 899 and other sites in the vicinity.

THE EXCAVATIONS

The extent of excavations and spatial relationship of the three sites is shown in Fig. 2. Each site is described separately.

R11/887

This site was situated on a level hill-top bisected by Fisher Road. The hill formed the highest point of the block of land, being some 20 m a.s.l. Before the excavation shell midden, earth ovens, postholes and a pit were visible in the eastern side of the road cutting. Formerly this site stretched across to the western side of the road to where earlier bulldozing had revealed the presence of shell midden and artefacts. Figure 3 shows all the features excavated at this site.

Stratigraphy

The stratigraphy of this site was simple, with four main layers. Cross-sections of the west baulk of the main trench and the eastern road cutting are shown in Fig. 4. Their locations are shown in Fig. 3

Layer 1a: The turf and topsoil. This was characteristically a dark brown friable loam between 50 and 100 mm in depth. The layer contained European material including broken glass bottles, iron straps and staples.

Layer 1b: The midden layer. The matrix was similar in colour and texture to layer 1a but contained shell midden and charcoal. It was present only in the south-western part of the site. It was up to 0.2 m deep in the road cutting but had disappeared some 2 m east of the fenceline.

Layer 2a: The natural subsoil. A yellowish/brown weathered volcanic tuff. Features were cut into this layer. Where layer 1b did not intrude, this layer was separated from layer 1a by a mottled interface containing charcoal flecks.

Layer 2b: Banded yellow/brown tuff.

Excavation results

A number of structural features were excavated. In only one area were these features superimposed, where a probable house and a number of postholes were replaced by a cooking area/midden dump. Elsewhere there was no indication as to whether the features were contemporary. However, as they appeared to be separated into groups, which may reflect different activity areas within the site, the more likely inference is that all should be assigned to a single short phase of occupation.

Over 100 postholes were recorded. They ranged in size from small stakeholes such as those at the south-east of pit A (40 x 60 mm deep) to more substantial ones up to 0.3 m in diameter and up to 0.35 m deep. The fill of the postholes was a dark brown soil.

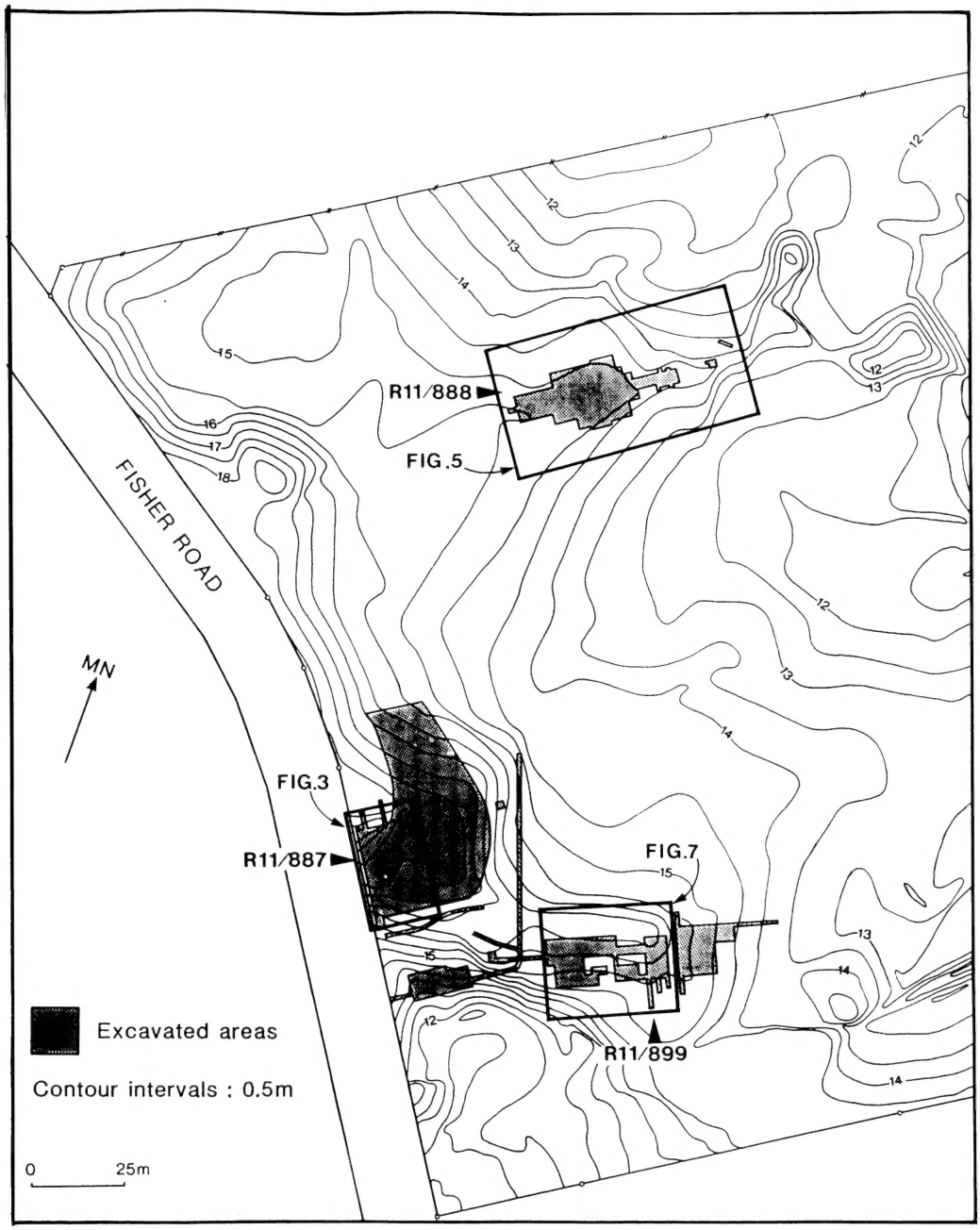


Fig. 2. Sites R11/887, 888 and 899. Contour map showing areas excavated and spatial relationships of the sites.

Almost all the artefacts found at this site occurred in the same general area as the postholes and it is possible that the structures may have been for tasks involving the use of stone tools, adze maintenance and possibly stone tool manufacture (see portable artefact discussion below).

There were six pits with a similar southeast-northwest alignment which may indicate contemporaneity. None of the pits showed any signs of natural in-filling. Table 1 lists the dimensions of all of the pits.

Pit A would appear to have been used for two separate purposes, the first of these was as a fire-pit, indicated by the red ash at its base. A similar pit was also excavated within a house at R11/899 (see below). Pit A was later re-used as an earth oven.

Shallow pits similar to C, D, E and F (of which only a corner remained) have been excavated in the Auckland area at Rahopara, Castor Bay (R10/21, Green 1970:19), Hamlins Hill (Davidson 1970a:110; Walton 1979:107), Motutapu Island (R10/38, Davidson 1970b:39) and Te Pane o Horoiwi (R11/357, Sewell 1986:fig 5). The function of such pits is unclear. Green (1970:19) argued that the pit at Rahopara most likely represented a sunken-floored "domestic unit" (i.e. house) as it would not have provided the consistency of temperature or humidity thought to be decisive factors in the use of deep pits for storing kumara (Groube 1965:93).

Davidson discussed the function of the shallow pits at R10/38 (Davidson 1970b:56). She considered the criteria currently accepted as useful in defining a house: the presence of a stone-lined hearth and "domestic litter". The former she discounted as a universal attribute of a house since recognisable houses at R10/31 and Hamlins Hill did not have them. This is also the case for the houses excavated at R11/899 (discussed below). She felt that the lack of any domestic litter (= stone material) was a strong argument against interpreting the structures at R10/38 as forms of houses, and concluded that they were primarily for storage, although not completely discounting alternative uses (Davidson 1970b:56).

The lack of domestic litter in any of the structures that were clearly houses at R11/899 throws doubt on this means of distinguishing between the use of a shallow pit as a house or for storage. The many ethnographic records (e.g. Phillipps 1952:24, Thompson 1859) of small slightly sunken sleeping houses suggest that some shallow pits are likely to have been used for this purpose. For the particular form of shallow pit under discussion, the presence of absence of stone flakes would appear to be an unsatisfactory criterion by which to define a house. However, by discarding such markers one is no closer to defining the attributes of a house.

Eight earth ovens were excavated. One of these was visible in the road section where two other separate earth ovens were also noted (Fig. 4). They all originated in the layer 1b midden and were cut through into the subsoil beneath. The rocks used for ovenstones were scoria, which, although not ideal for heat retention, would have been in plentiful supply. Many were fire-cracked. Beside the ovens were two small piles of ovenstones.

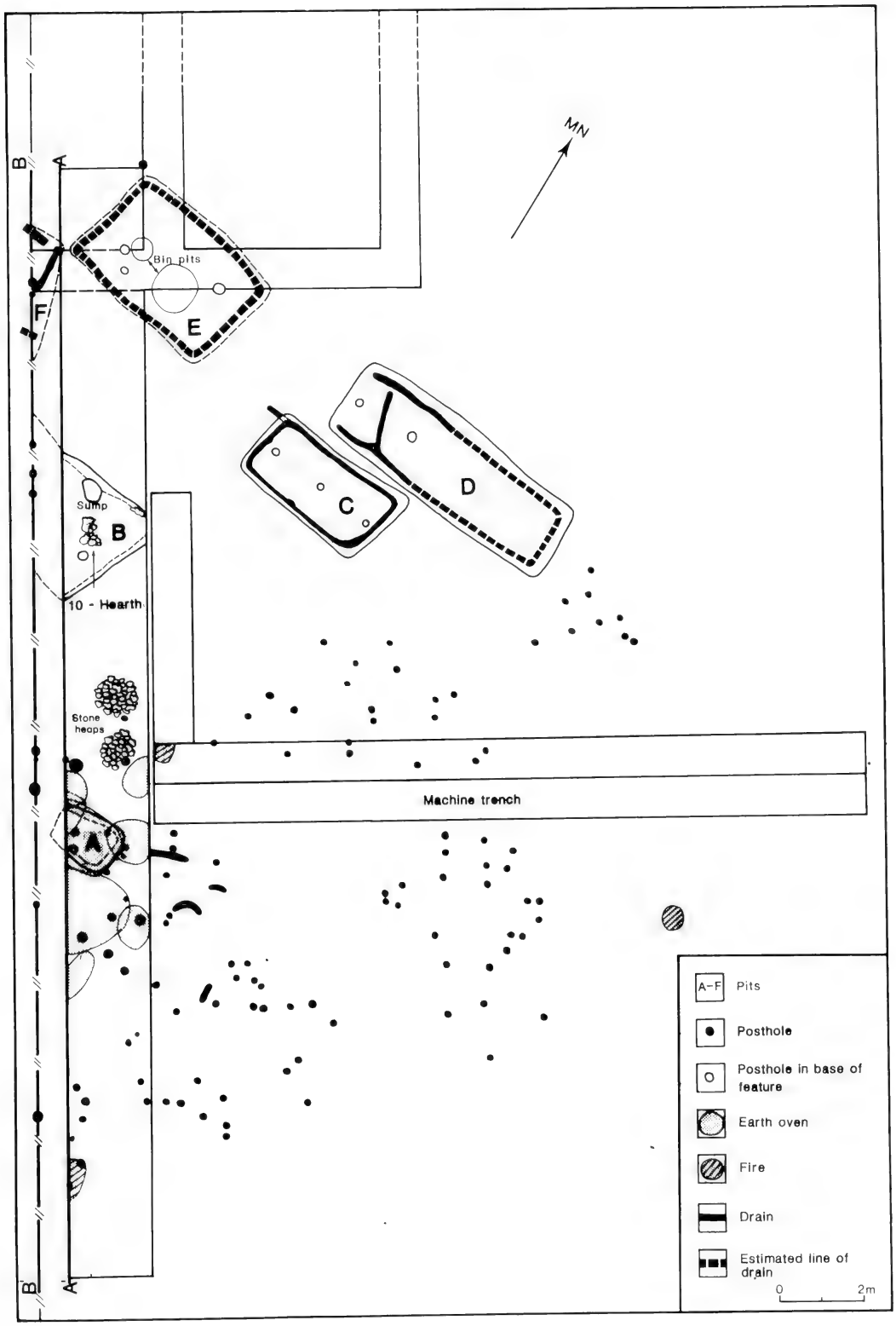


Fig. 3. R11/887. Plan of excavation showing all features and location of cross-sections.

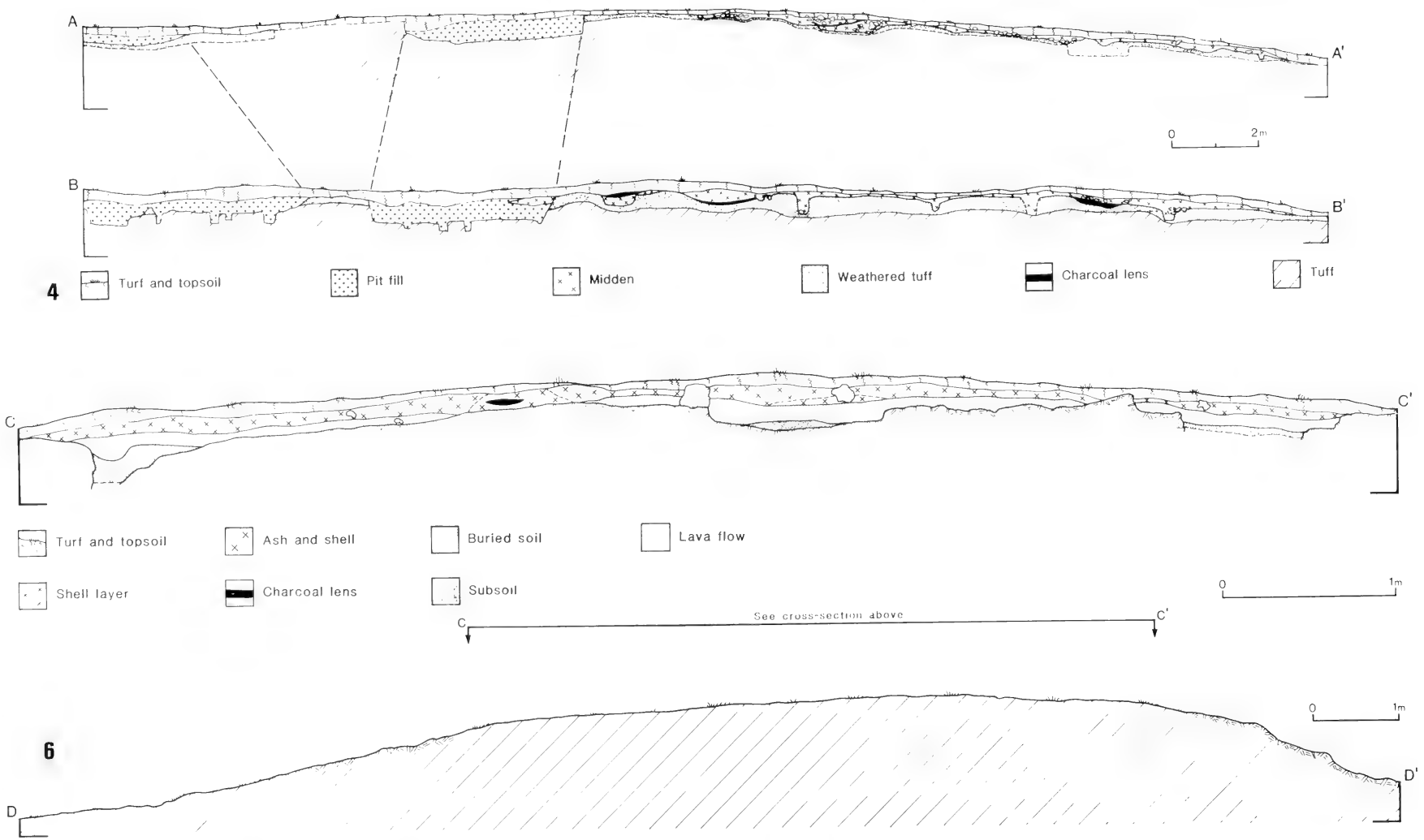


Fig. 4. R11/887. Main cross-sections of the site. Above. West baulk main trench. Below. East baulk of road cutting.
Fig 6. R11/888. Profile and cross-section of the site.

Table 1. Estimated sizes of pits, Sites R11/887 and R11/899, Fisher Road.

Site	Pit	Length (m)	Width (m)	Depth (m)	Fill
R11/887	A	1.75	1.25	0.26	Scoria stones in matrix of black, greasy soil and fragmentary shell. 5 mm layer of red fire ash at base.
	B	3.0	2.80	0.50	Homogeneous dark brown soil.
	C	3.60	2.10	0.25+	Homogeneous dark brown soil.
	D	1.90	6.20	0.35	Homogeneous dark brown soil.
	E	2.80	4.12	0.35	Homogeneous dark brown soil.
	F	?	?	0.35	Homogeneous dark brown soil.
R11/899	G	4.60	2.70	1.0	Dark brown friable soil and charcoal and lumps of tuff.
	H	5.80	2.30	1.0	Dark brown friable soil and charcoal and lumps of tuff.
	I	3.88	3.08	?	Mottled brown soil.
	J	2.60	1.50	1.50	Dark brown soil, stones, charcoal and lumps of tuff.
	K	4.30	2.0	1.50	Dark brown soil, stones, charcoal and lumps of tuff.
	L	4.10	2.0	0.48	Mottled brown soil and lumps of tuff.
	M	2.0	1.20	0.25	Dark brown soil.
	N	1.40	0.90	0.25	Black/orange mottled soil.
	O	2.50	2.0	?	Dark brown soil.
	P	2.30	1.30	?	Dark brown soil.
	Q	5.0	2.30	0.94	Mottled brown soil.
	R	5.0	2.40	?	Mottled brown soil and charcoal.
	S	7.60	5.90	1.10	Mottled brown soil, tuff and shells.
	T	5.0	2.40	1.0	Yellow brown soil with inclusions of charcoal, grey and orange tuff.
	U	5.10	2.80	1.40	Yellow brown soil and yellow/red tuff.
	V	6.10	3.20	1.10	Yellow brown soil and lenses of charcoal and shells.
	W	5.08	2.28	0.64	Yellow brown soil.
	X	4.0	1.80	?	Yellow brown soil.
	Y	7.0	4.2	1.34	Yelllow brown soil and yellow and red tuff inclusions.

These earth ovens formed a distinct activity area dedicated to cooking. One of the ovens was built in and over pit A. There were also a number of postholes underlying the ovens. Whilst some may relate to earlier structures, others may be contemporary with the ovens. Three surface fires and a hearth were also excavated.

R11/888

The surface evidence of this site was a quantity of very crushed shell eroding down the exposed sides of the lava flow. A laid shell floor and a number of structural features were excavated. They are shown in Fig. 5.

Stratigraphy

A profile across the lava flow and a cross-section of the archaeological deposit are shown in Fig. 6. The location of the profile and cross-section are marked on Fig. 5. The stratigraphy was as follows:

Layer 1a: Turf and topsoil 50-100 mm in depth.

Layer 1b: Dark brown friable soil similar in composition to layer 1a but with the addition of flecks of charcoal and, in the north-easterly portion of the area excavated, containing large quantities of shells.

Layer 2: Buried topsoil, dark brown in colour — present only in the most north-easterly area beneath the layer of shells.

Layer 3: Subsoil — brownish yellow.

Layer 4: Basaltic lava.

Excavation results

The features excavated at this site were three structures, two earth ovens, a fire and two groups of postholes, one of which was at the south-west edge of the shell deposit. A layer of shells covered most of the north-eastern portion of the lava ridge decreasing in depth and quantity to the south-west. With the exception of one obsidian flake all the artefactual material was found on the surface of the shell layer. Intermixed with the shells were small lenses of ash not directly asociated with any *in situ* fire. The ash was deposited at the same time as the shells. Within the layer of shells there was a hearth 0.35 m in diameter. An earth oven lay to the south-west of the shell layer, and a second cut into Structure A.

The three structures had a similar brownish/yellow fill. No postholes were found around the perimeter of the structures. The interior postholes were cut through the subsoil until the lava flow was reached.

Structure A was rectangular, 8 x 3 m in size, with a central row of postholes. A peripheral drain was dug into the subsoil by 70 - 90 mm. There were additional internal drains which were of similar depth. This structure was cut into by a later earth oven. The three postholes to the south west of this structure may possibly have formed part of it.

Structure B is estimated to have measured 7 x 3 m. The internal postholes did not form a central row. The fill of the drain around the perimeter was not removed, but the dimensions were likely to have been similar to those at Structure A.

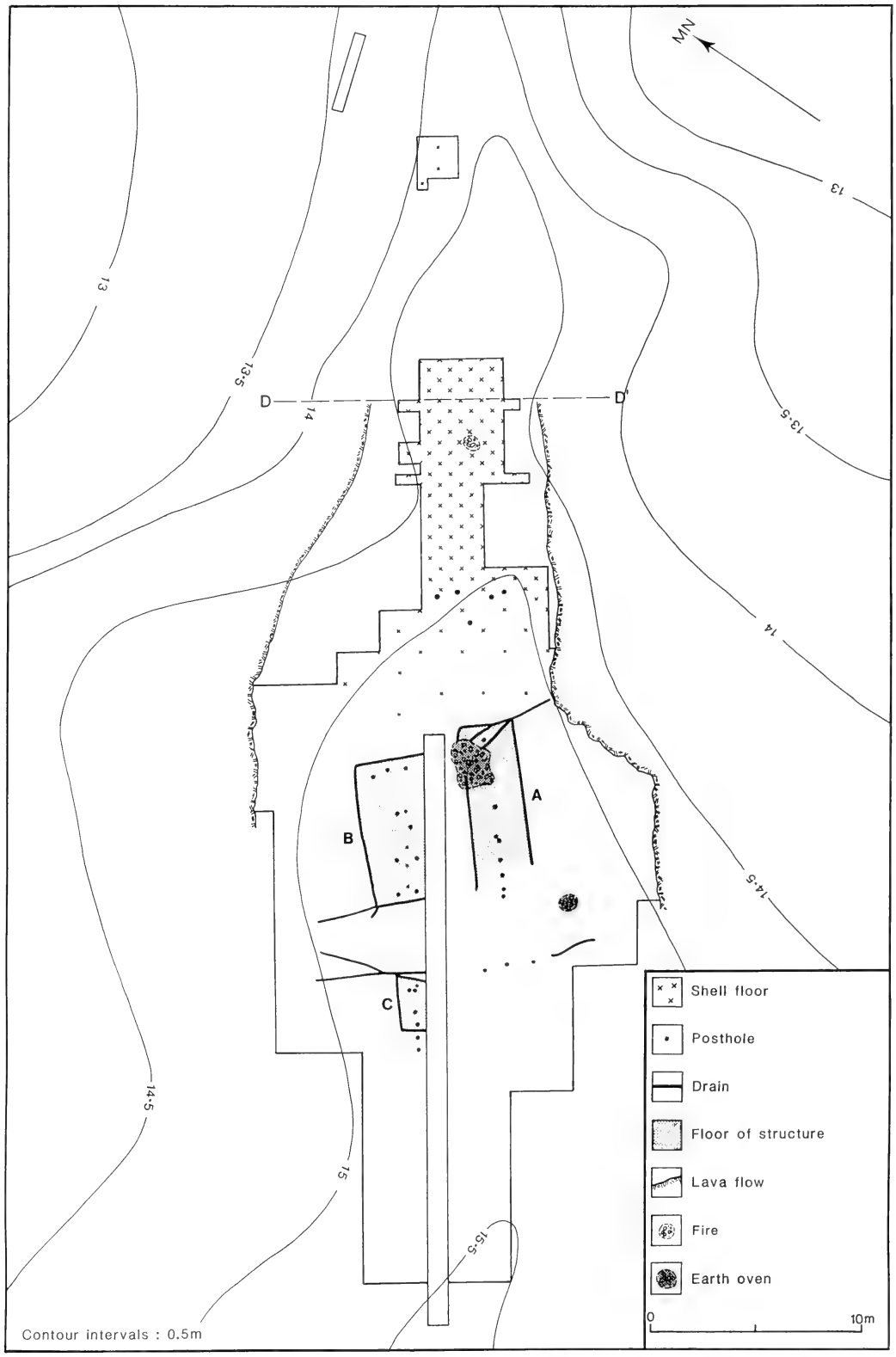


Fig. 5. R11/888. Plan of excavation showing all features and location of profile and cross-section.

Structure C probably measured 2.5 x 1.5 m. The internal postholes formed a central line. The largest posthole showed evidence of both posthole and postmould. The peripheral drain was 60 mm deep. There was a second drain, 0.20 m deep, beside the north eastern end of this structure, and which ran off to the north for 5 m to the edge of the level ridge top.

The structures were above-ground buildings with slightly sunken floors. The lack of corner posts or any substantial posts around the perimeter suggests buildings with the eaves resting directly on the ground. Buildings of similar construction were depicted by some of the early visitors to New Zealand (e.g. Wright 1950: opp. p. 176) and often referred to as storehouses. Crozet recorded that in one village in the Bay of Islands there were three kinds of storehouse — one for tools and spare weapons, one for food (kumara, dried shellfish, fernroot) and calabashes of water and the third for storage of nets, fishing gear, cordage and paddles (Ling Roth 1891:32). It is possible that the structures at this site were used for storage of similar equipment.

The shell layer extended across the end of the lava ridge (Fig. 5) filling up all hollows and undulations. In places the old topsoil was visible beneath the shells. Whilst the presence of shell midden can be indicative of a dump, it is contended in this case that these shells were laid to produce a level living surface. Following Nichol (1980b:96) the shells were examined and found to be food debris rather than beach wrecks.

There are records of shells, together with spoil and rocks, being used as building materials in the construction of terraces in the Auckland area. At Ellett's Mountain an artificial terrace with a depth of nearly 2 m of shells was recorded (J. McKinlay pers. comm. 1986), while at Mount Wellington, Mount Roskill, Taylor's Hill and One Tree Hill similar terraces were found (Davidson 1982:36). At site T11/219, Brier's Block, a rectangular deposit of shells was interpreted as a house floor although no postholes were discovered (Furey 1987:121).

The shells on the lava flow here produced a clean, well-drained and mud-free living surface. It was a deliberately laid deposit rather than a dispersed midden dump. The discrete lenses of ash support this interpretation. The distribution of the stone flakes at the surface of, and coinciding with, the shell floor suggests that they had been deposited after the floor has been laid during its use as a working floor.

R11/899

The evidence here consisted of shell midden, large pits, stone-edged hearths, earth ovens and houses. These features occurred on a flat terrace bounded to the north by a high and conspicuous lava flow. All features excavated are shown in Fig. 7.

Stratigraphy

The stratigraphy of this site was similar to that of R11/887 with the exception that one portion of the site was built up to form a terrace. Cross-sections through the main area of excavations are shown in Fig. 8. The locations of these sections are marked on Fig. 7. The layers were as follows:

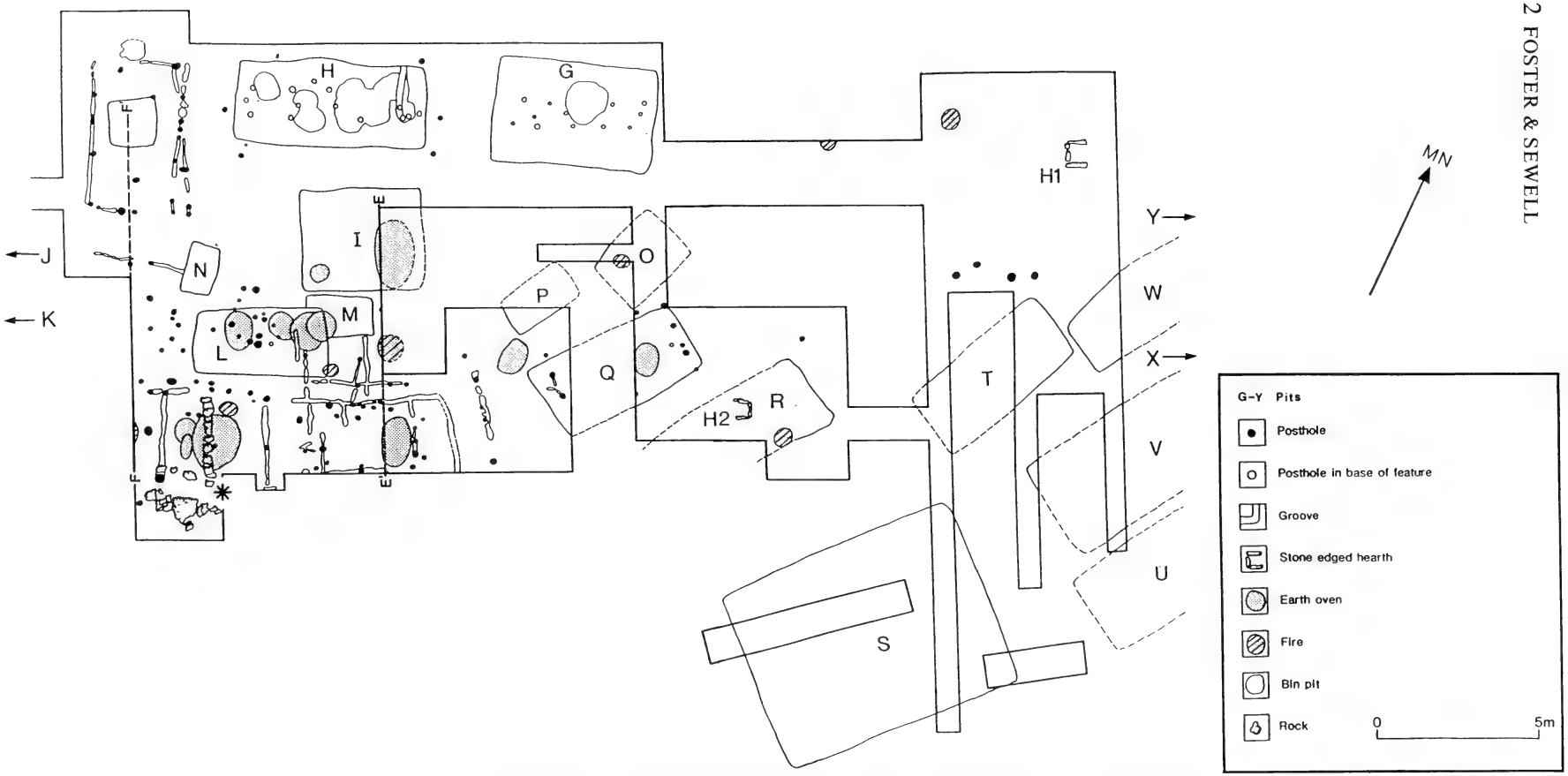


Fig. 7. R11/899. Plan of excavations showing all features and location of cross-sections.

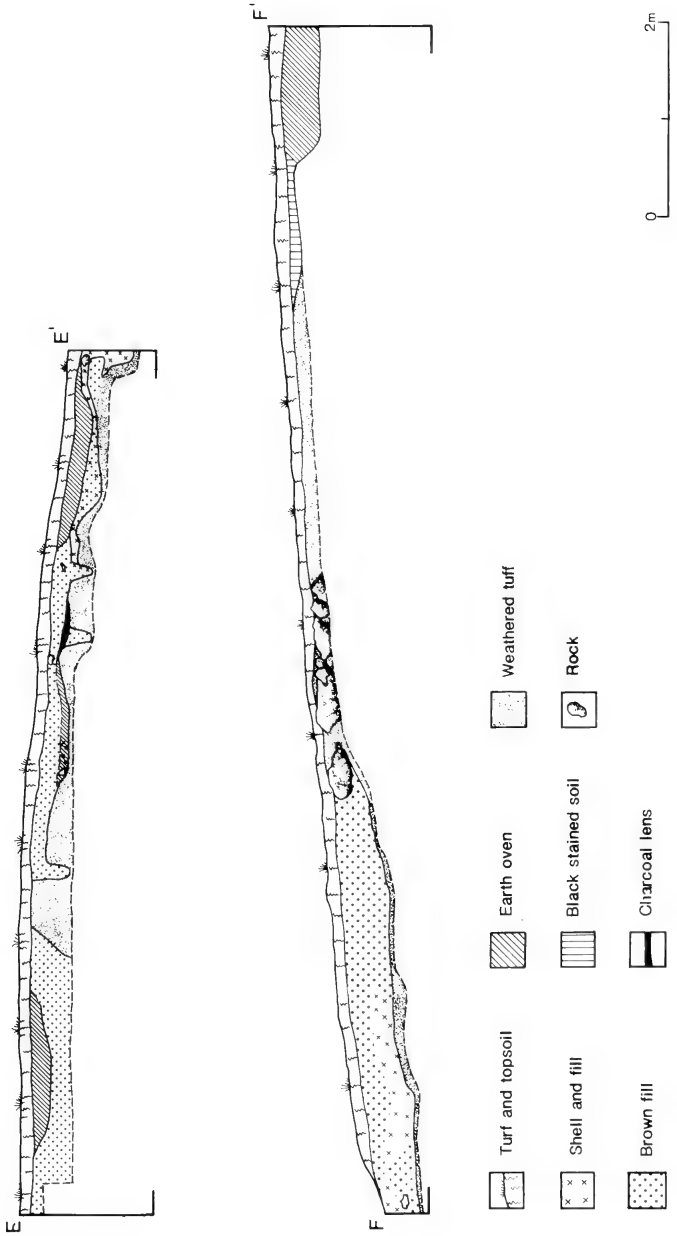


Fig. 8. R11/899. Main cross-sections of the site.

Layer 1: Turf and topsoil 50 - 100 mm in depth.

Layer 2: Redeposited brown friable soil with inclusions of charcoal, rocks, pieces of tuff and in places pockets of shell midden. It had been deposited to the south of the lava flow to form a terrace in order to increase the level living space. In other portions of the site where layer 2 did not occur there was mottled interface between layers 1 and 3a.

Layer 3a: The natural subsoil — a yellow brown weathered tuff.

Layer 3b: Banded tuff.

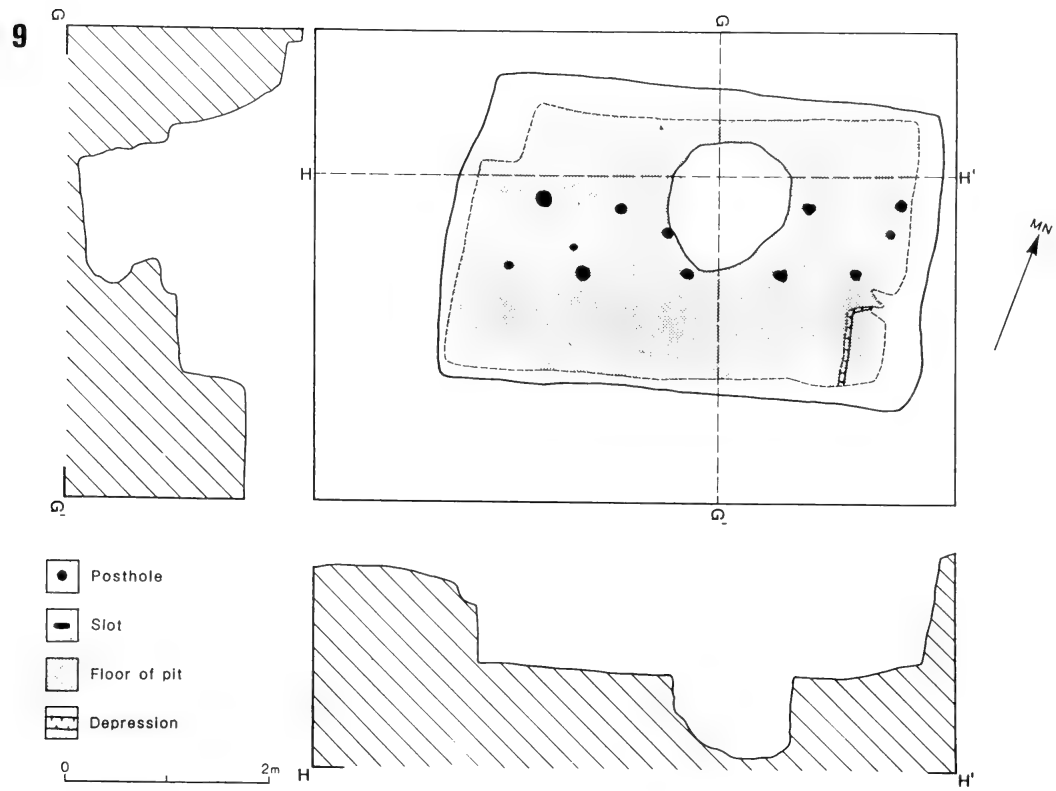
Excavation results

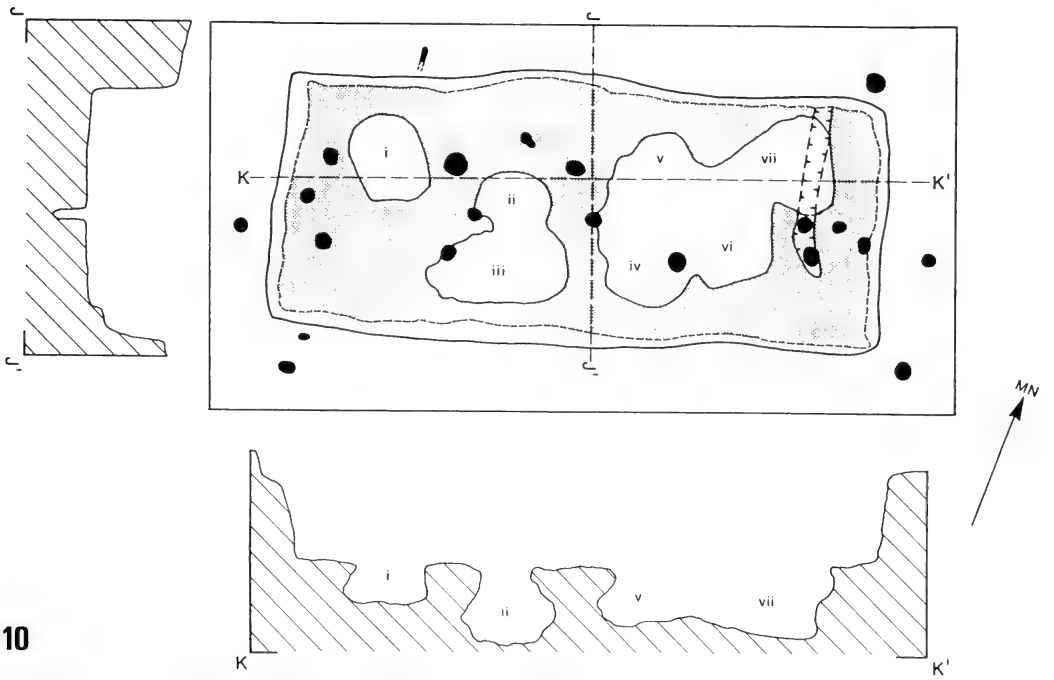
Some of the features excavated were dug prior to deposition of layer 2. (For example pits L and M and the two earth ovens beneath the rock wall marked * on Fig. 7). After the terrace had been built up several houses were constructed and other features were found representing use of the area after the abandonment of some of the houses. The evidence suggests continuous use of the site over a period of time during which houses were built and rebuilt, rather than two or three separate occupations.

Pits G, H, M and N (Fig. 7) were totally excavated. Pits L and Q were partially emptied. The remaining pits (I, O, P & R to Y) were either recorded but not excavated or were located by machine trenching. There was no evidence of natural infilling. The majority of the excavated pits contained an earth oven or the remains of a fire within the hollow caused by the sinking of the original fill. Dimensions and fill of all the pits are set out in Table 1. The excavated pits demonstrated considerable variety both in size and internal features. Pits G and H are illustrated in Figs. 9 and 10.

Pits G and K had circular bin pits cut into their floors, whilst pit H had seven intercutting bin pits, indicating successive use. Although uncommon in the Auckland region, bin pits of this type have been recorded from Mount Roskill (Fox 1980:fig. 10) and R10/26 on Motutapu, where multiple floor pits were present (Sullivan 1972:32). Sullivan suggested that they were used as repositories for seed kumara (1972:42). Other bin pits have been recorded from further afield, from Skipper's Ridge, Coromandel (T10/165, Davidson 1975:11), Kauri Point (U13/45, Green 1963:154) and Kotare Pa, Raglan (R14/8, Pos 1964:112). The floor pits from this site are of similar size and depth to those at R10/26. One posthole in pit H was cut into the fill of bin pit iii, which reinforces this idea of successive use and suggests that the pit was re-roofed at least once, with probably a central row of posts being replaced by a double row. Pit G also contained a corner buttress which extended from the floor to the top of the pit and pit Q an end buttress and a shelf around two sides. Whilst a corner buttress is unusual, they have been recorded at pit F at Hamlins Hill (Davidson 1970a:110), pit J at Kauri Point Open Settlement (Green 1963:154) and at Skipper's Ridge (Davidson 1975:11).

End buttresses occur in many pits — sometimes associated with roof supports or as an entry step (Fox 1974:149). The end buttress in pit Q — used as a step — was comparable to those in pit K at Hamlins Hill (Walton 1979:108) and at three sites on





Figs. 9, 10. 9. R11/899. Plan and profiles of Pit G. 10. R11/899. Plan and profiles of Pit H.

Motutapu — pit 5 at R10/38 (Davidson 1970b:41), pit E at R10/26 (Sullivan 1972:56) and pit 2 at R10/31 (Leahy 1970:64). In composition the buttress closely resembled that in pit 4 at R10/31 (Leahy 1972:18); in both cases the buttress consisted of compacted clay placed in the pit after it had been dug. The internal ledge running along the end and one side wall in pit Q was an interesting attribute. A similar feature was encountered in pit T at Hamlins Hill (Walton 1979:111) and in pit B at R10/31 (Sullivan 1972:35), where Sullivan (1972:39) suggested that the ledge was used to facilitate entry into the pit. As the ledge in pit Q ran along two walls it would appear unlikely that it was dug primarily for that purpose.

There were a number of houses. With the exception of one, all were constructed on the built-up terrace and were superimposed. The evidence for the superimposed houses consisted of grooves and postholes. The grooves were from 0.20 - 0.25 m deep and 0.15 - 0.20 m wide; postholes were found within or alongside the grooves. These were up to 0.34 m deep. The outline of the houses was unclear in the fill of pit L and to the west of this pit.

Not all the grooves and postholes came from the top of the midden-fill layer. It is probable that as one structure was replaced by another more fill was spreading over the living surface. The grooves and postholes indicated that a number of houses were constructed in this area, several with an east-west alignment and at least two on a north-south line.

The line of rocks (marked * on Fig. 7) was present on the same alignment as the north-south grooves. The rocks used were naturally squared and were laid so that their upper surfaces were level. It is likely that these rocks formed a part of the foundations for one of the houses.

Only one of these superimposed houses had any form of heating — an oval firepit. This firepit, together with the adjacant posthole and groove, belonged to one of the earliest houses.

The separate house was of similar construction and found to the north of the superimposed houses (Fig. 7). It measured 2.8 x 6 m (including the porch of 1.4 m width). The postholes varied in depth from 0.10 - 0.26 m. The porch and entrance faced south.

Within the house there was a firepit measuring 1.50 x 1.48 by 0.25 m deep. Both the base and sides of the firepit were burnt. A posthole, postdating the house, was cut into the north-eastern corner of the firepit. The eastern wall of this house would appear to have been replaced.

It is now accepted that structures such as these, with the outline defined by grooves and postholes, were houses. Similar examples have been found at Hamlins Hill (Davidson 1970a:116, Irwin 1975:52, Walton 1979:112, Nichol 1980a:221), Mangakaware II (S15/18, Bellwood 1978:23), Orakei (R11/87, illustrated in Davidson 1984: fig. 101), R10/31 Motutapu (Leahy 1970:62) and Hawkins Hill (Coates 1986:247).

The separate house appears to be one of the best examples of this type of construction found in Auckland to date, with evidence of almost the complete building.

Two stone-edged hearths (marked H1 and H2 on Fig. 7) were excavated. Hearth 1 consisted of six naturally squared scoriaceous basalt rocks set into the subsoil and arranged to form three sides of a rectangle, the internal measurements of which were 0.50 x 0.45 m. There was no evidence to suggests that a fourth side was ever present. Within the hearth were lenses of ash and charcoal. A thin scatter of charcoal was present to the west of the hearth.

Hearth 2 measured 0.40 x 0.32 m. It was also three sided and made from scoriaceous basalt constructed on the compacted fill of pit R. A semi-circle of small pebbles formed the western boundary. It was filled with many layers and lenses of white, grey and red ash and charcoal. Ash and a smear of charcoal spilled to the west of the hearth.

There were four postholes in a line 3 m south of hearth 1 and eight near hearth 2. These few postholes in the same general area as the hearths do not appear to be directly associated with them and do not provide adequate evidence to postulate any structure related to either hearth.

Rectangular stone-edged hearths have often been used as an indicator for the presence of a house (e.g. Groube 1965:44). Examples of houses with such hearths have been found at a number of sites in New Zealand.

In Auckland no stone-edged hearths in direct association with a house have been excavated. Leach (1972:67) recorded such hearths at Mount Roskill, Taylors Hill and One Tree Hill with no definite evidence that they occurred within a structure. At Palliser Bay some stone-edged hearths were recorded without evidence of a surrounding house (Leach 1972:70-71). Further afield in Polynesia stone-edged hearths are well documented both within and outside houses (Green 1979:94). There is sufficient evidence to suggest that stone-edged hearths without houses are not unusual and fall into the general Polynesian pattern. The hearths at R11/899 would appear to have been constructed in the open in the vicinity of houses and they could have formed an outdoor focal point of the settlement.

Numerous earth ovens were found at this site. With the exception of those beneath layer 2 they came from the vicinity of the superimposed houses. The remaining ovens came from the top of the midden/fill layer 2.

There was a small low-lying terrace below and to the west of R11/899 and south-east of R11/887 (Fig. 1.). Excavation of this terrace revealed a single pit (K) and eight earth ovens. A number of postholes in the vicinity of the ovens probably indicate windbreaks or sheds relating to the ovens.

PORTABLE ARTEFACTS

Table 2 lists all the portable artefacts from the three sites by site and category. The formalised artefacts are typical of the Auckland area. Eight adzes and adze roughouts were recovered. They are illustrated in Figs. 11 to 19. The presence of roughouts and reworked adzes (adze 13 reworked as a fine chisel), together with adze flakes (particularly at R11/887 where clusters of adze flakes were found), indicates that adze maintenance was undertaken.

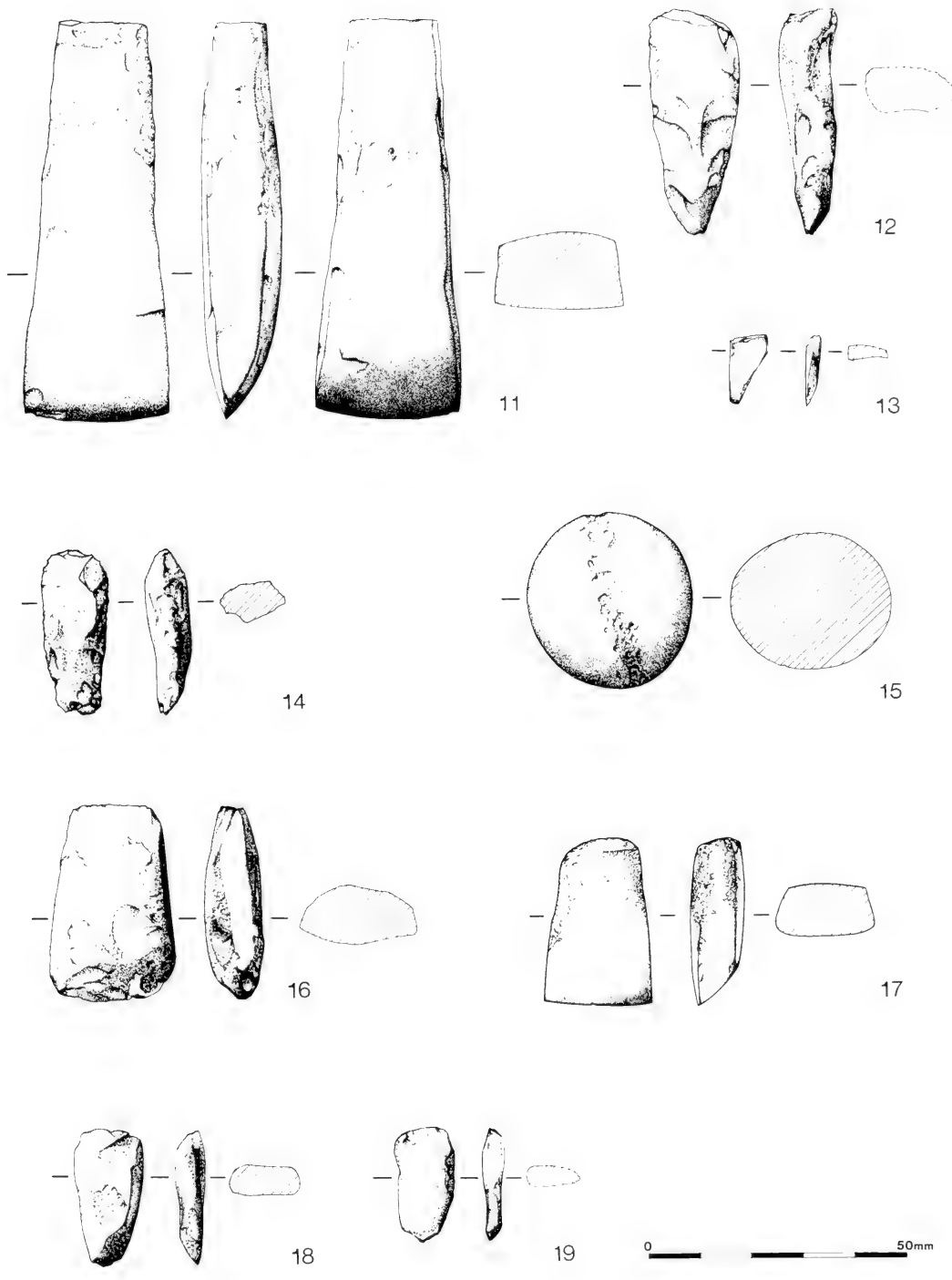
Table 2. Portable artefacts from Sites R11/887, 888 and 899, Fisher Road.

TYPES	SITE		
	R11/887	R11/888	R11/899
Adzes	2	1	4
Roughouts	1		
Polished Flakes	13	1	3
Hammer Stones	2		2
Obsidian Pieces	187	8	68
Stone Pieces	126	16	55
Fishing Sinker		1	

The non-formalised artefacts consisted of obsidian flakes and cores, greywacke flakes and cores and a scattering of other stone material. A total of 263 pieces of obsidian were recovered. Most came from R11/887 (71%) with fewer from R11/899 (26%) and R11/888 (3%) respectively. 36% of the obsidian was green, possibly from Mayor Island. The remainder of the obsidian was grey, with possible sources on Great Barrier Island and from numerous locations on the Coromandel Peninsula. No significant differences were noted in the relative percentages of green to grey obsidian amongst the three sites.

There were 197 other stone flakes from the sites — 64% from R11/887, 28% from R11/899 and 8% from R11/888. The material was essentially greywacke (95.5%) with a few chert (3%) and local volcanic stone (1%) pieces. Many of the greywacke flakes were struck from water rolled cobbles and could have been collected from the shores of the Hauraki Gulf, a major source being Motutapu Island.

In general, while actual numbers of flakes recovered from each site showed considerable variation, the significantly higher number of flakes at R11/887 suggests a more intensive activity concerned with the use and flaking of stone. There was no significant difference in size or shape of obsidian flakes from the three sites. Fredericksen suggested (Foster & Sewell 1988:App. 5) that this material was debitage from tool manufacture, with only two flakes showing any sign of usewear. However, it is possible that the flakes were used for some other function which left no recognisable usewear patterns.



Figs. 11-19. Portable artefacts from sites R11/887, 888 and 899. 11. Adze (R11/887). 12. Broken adze roughout (R11/887). 13. Reworked chisel (R11/887). 14. Adze (R11/888). 15. Fishing sinker (R11/888). 16-19. Adzes (R11/899).

DISCUSSION AND CONCLUSION

Dating

The Radiocarbon dates obtained for the three sites are listed below.

Lab. No.	Years B.P. Old half-life (5568)	Years B.P. New half-life (5730)
NZ 7048	405 ± 25	415 ± 25
NZ 7049	380 ± 40	395 ± 40
NZ 7064	390 ± 30	400 ± 30
NZ 7065	380 ± 30	395 ± 30

The dates obtained indicate that the main occupation of all three sites was in the mid to late sixteenth century. There is no stratigraphic link between the dated events, but the close similarity of the dates, together with the excavation evidence, suggests that the sites were likely to be contemporary. The significance of these dates in relation to each other and to the other dated sites in the area (Hawkins Hill, Westfield) has been discussed by Foster (1986), who concluded that, in their probable dates, none of these sites could be distinguished statistically, all are in the same general age range.

Economy

Evidence of the economic base of the inhabitants of these sites may be gained from the analysis of faunal remains (Foster & Sewell 1988:App. 4) and by inference from other excavated evidence.

The content of the faunal samples was similar to that of other Auckland sites, consisting of a number of shellfish species, fish and dog. In particular there were similarities with the other excavated sites in the area (Hamlins Hill, Hawkins Hill, Westfield), where similar shellfish species, primarily cockle *(Chione stutchburyi)*, a predominance of snapper *(Chrysophrys auratus)* amongst the fish species and small quantities of dog *(Canis familiaris)* were present.

The shellfish indicated the exploitation of several ecological zones (estuarine, rocky shore and open coastal). Estuarine species predominated. Cockle was the major species present (95%), which along with the other estuarine species could have been collected from the nearby Tamaki River or the Manukau harbour a little further to the west.

A number of fishing techniques were indicated by the types of fish species present. The usual method of taking snapper and trevally *(Caranx geogianus)* was by bait-line, although seine nets were equally effective. The number of other small fish such as small shark, mackerel *(Trachurus declivis)*, stargazer *(Geniagnus monopterygius)* and mullet *(Aldrichetta forsteri)* indicate that netting was a major method of capture. The presence of barracouta *(Thyrsites atun)* and kahawai *(Arripis trutta)* suggests the use of trolling lures.

The dog skeletal remains represented all body parts, suggesting that butchery of these animals took place at the site. One pelvis had cut-marks on the ilium which are consistent with the flensing of the flesh off the bones, as discussed by Taylor (1984).

No direct evidence of gardening was found. However, the large number of storage pits suggests that considerable energy was expended in the production of root crops, even allowing that not all pits would have been in use at the same time. Despite attempts to identify areas where gardening took place, no specific evidence could be found that pointed to any particular areas of gardens. Clearly gardens must have been present somewhere in the vicinity. They may have been present and not located or the gardening activities practised may have left no visible trace. A third possibility could be that the gardens were located in some area beyond the block investigated, such as between the settlement and the Otahuhu Creek.

The nature of the settlement

Although one of the most fequently encountered site types in New Zealand is the open settlement, characterised by pits, terraces and/or midden, excavation has been limited and generally only involved small segments of such sites. Consequently it is difficult to assess the nature of settlement at these sites or to compare adequately one such site with another.

As the Fisher Road excavations were of a rescue nature it was possible to undertake extensive area excavation. The research proposal envisaged that such an excavation would add considerably to our knowledge of open settlements and their structure. The excavations reported here revealed a considerable portion of the three sites. They provided sufficient information to assess the nature of settlement of each site and to discuss their relationship to each other and other sites in the vicinity.

Groube's study (1964; 1965) of settlements still remains the basis for discussion of the nature of undefended sites. He ranked settlements of four levels staring with the "minimal domestic unit", which consisted of a number of structural components such as those for storage, dumping and cooking in addition to a house or site for sleeping (Groube 1964:53). The second level — the communal — comprised a number of domestic units and sites of specific communal activities (Groube 1964:56). The third and fourth levels add the natural environment (economic level) and the wider political aspects of a large unit consisting of clusters of communal units (political level) (Groube 1964:58).

Sites R11/887 and 899 fall into the first of Groube's categories. Both contained evidence of structures, storage and cooking. Midden was found at both sites although no areas used exclusively for the dumping of rubbish were found. The evidence at R11/888 was less clear. It did not contain all the elements considered to be indicative of a domestic site, particularly in the lack of storage pits and a discrete cooking area. The most likely explanation for this site is that it was a specialised satellite area of the other sites. This is supported by radio-carbon evidence. The age estimates from the three sites are so close as to indicate their contemporaneity. Together they may be regarded as a single communal unit at Groube's second level — a hamlet. The sites within this hamlet encompassed a wide range of activities including living, the preparation and cooking of food and storage. In addition there were certain locations where specialised activities took place. These were an area where stone tools were used and possibly manufactured at R11/887 and an open working floor at R11/888 (possibly for manufacture and maintenance of nets).

The two other sites which have been excavated in the same lava field (Westfield and Hawkins Hill) were also domestic units with evidence of houses, cooking, midden dumping and storage. In addition the Westfield site contained a specialised working area which was interpreted as a place where woodworking was undertaken (Furey 1986:21). These sites have features in common with the open settlement at Fisher Road and are of similar age. It is suggested that all of these sites would have been occupied by contemporary, extended, and probably related, family groups.

The settlement on Hamlins Hill is very similar to the sites around Te Apunga o Tainui. All were occupied in the same general time range, were located close to one of the canoe portages and contained a similar range of features. At Hamlins Hill about 500 m^2 was excavated and the structures indicated that it was part of a large settlement with construction of consecutive buildings in the same locality. This is very like the pattern at Fisher Road, where occupation is interpreted as continuous over a period of time with houses being built and re-built and no indication of any significant breaks in occupation.

Groube (1965:52) argued that the pa was the focus of a more extensive settlement pattern with everyday economic activity undertaken in dispersed hamlets or huts. The use of the pa as a focal point in studying prehistoric settlement patterns in New Zealand has been used with success by later archaeologists such as Irwin (1985) in understanding the settlement patterns of the Poutu Peninsula, northwest of Auckland, and by Phillips in her study of the Karikari peninsula in Northland (Phillips 1987). In discussing the political unit Groube (1965:14) pointed out the problem of interpreting such a unit without adequate time control. Within the settlements excavated around Te Apunga o Tainui the dates show occupation in the 16th century with no evidence of any earlier occupation. Although no dates are available for occupation of the cone it would seem reasonable to assume that it was in use at the same time as these surrounding hamlets and was in fact the political centre of these settlements.

The Otahuhu portage was one of the major portages between the Waitemata and Manukau Harbours and the inhabitants of the pa at Te Apunga o Tainui and its associated open settlements must have had considerable control over its use. In this respect it is of note that close examination of the remainder of the Fisher Road block did not indicate the presence of any significant habitation sites between those excavated and the Tamaki River. This can be seen as supporting the proposition that the focus of settlement in this area was on the pa and the portage rather than on the main Tamaki River.

The interpetation of the excavations at Fisher Road presented here suggests that sites R11/887, 888 and 899 formed parts of a single hamlet. Horticulture and food storage were major subsistence activities, although it is clear that fishing and shellfishing were also of significance. There is evidence of tool manufacture, use and maintenance. The evidence also suggests that at least one specialised satellite area was present. The settlement was of a permanent nature, as evidenced by substantial houses and extensive storage facilities, and was probably occupied as a home base over an extended period of time by one group of people during the 16th century.

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A NEW GENUS AND SPECIES OF CARVENTINAE (HEXAPODA : HEMIPTERA : ARADIDAE) FROM NORTHLAND, NEW ZEALAND

M. KIRMAN

WAIKATO POLYTECHNIC, HAMILTON

Abstract. Modicarventus wisei gen. et sp.n. from the Mangonui district of Northland, is described and figured. This new genus of Carventinae shares several features with *Neocarventus* Usinger & Matsuda. A key to the genera of the New Zealand Carventinae is included.

The localities of specimens described here are in the isolated north-eastern tip of the North Island towards North Cape (Mangonui County).

Specimens are in the collections of the Auckland Museum (AMNZ).

Family ARADIDAE

Subfamily CARVENTINAE (Usinger, 1950)

KEY TO THE GENERA OF NEW ZEALAND CARVENTINAE

1. Rostrum arising from an open atrium (group I) ..... **Acaraptera** U. & M.
   Rostrum arising from a closed atrium (group II) 2
2. First and second abdominal tergites completely fused with metanotum and with mesonotum at middle ..... **Leuraptera** U. & M.
   First and second abdominal tergites separated from metanotum by a distinct suture 3
3. Medial region of mesonotum produced as a distinct large hexagonal prominence, merging into the metanotum. Sutures between thoracic segments very deep ..... **Clavaptera** Kirman
   Medial region of mesonotum produced backwards into the metanotum as a well defined posteriorly directed broad or angular lobe. Thoracic sutures distinct but not deep 4
4. Head with well developed, laterally directed, blunt post-ocular spines ..... **Carventaptera** U. & M.
   Head without postocular spines 5
5. Mesothoracic median lobe broad, occupying medial one third of the posterior margin of metanotum. Tergal disc with all sclerites distinct (4 lateral, 4 sublateral, and a longitudinal medial sclerite bearing scent glands ..... **Modicarventus** gen.n.

Rec. Auckland Inst. Mus. 26: 25-32 15 December 1989

Mesothoracic median lobe subtriangular forming a wedge-like division of the metanotum. Tergal disc with sublateral sclerites fused medially with medial longitudinal sclerite .....**Neocarventus** U. & M.

Kormilev's (1970) key for the genera of the Carventinae is now out of date as regards New Zealand. I propose the following modification. My key from couplet 2 can be inserted at couplet 19 of Kormilev's key.

The genus *Clavaptera* was described by Kirman (1985).

Genus **Modicarventus** gen.n.

Apterous. Elongate oval in body form, surface with a thin pale incrustation, particularly extensive on the head; thoracic sutures; and connexival segments.

Head wider than long; eyes small; anterior process prominent, the clypeus narrowing apically, with thick genae exceeding apex and forming a small cleft. Antenniferous tubercles short, blunt, conical. Postocular region of head not exceeding lateral margin of eyes; neck constricted. Antennae longer than head but not excessively long; first segment exceeding apex of head by half its length, fourth segment longest, second segment shortest, third segment shorter than first or fourth. Rostrum slender, especially near base, arising from a closed atrium well behind apex of clypeus.

Pronotum distinctly shorter than head; collar dorsally distinct, ring-like, with lateral tubercles, with a ring-like depression behind; a posteriorly directed subtriangular sclerite behind collar: hind margins roundly produced posteriorly; anterior margin subcontiguous with tubercles on collar, slightly anteriorly directed in female; anterior angles rounded in male, obtuse in female; lateral margins widening posteriorly (more strongly in female) and produced as acute lobes.

Mesonotum longer than pronotum at middle, produced prominently backward into a broad subrectangular lobe reaching the anterior margin of the basal abdominal segments and occupying the median third of the metanotum; anterior margin incised posteriorly forming an anteriorly directed median lobe; lateral margins widening posteriorly (more strongly in female) and produced as rounded lobes in male and acute lobes in female.

Metanotum divided into two by the mesanotal lobe, lateral margins widening posteriorly (more strongly in the female), posterior angles rounded.

Basal abdominal tergites fused medially, strongly elevated anteriorly, with a distinct medial longitudinal groove, narrowing posteriorly, almost reaching anterior margin, posteriorly with a short median longitudinal carina or elongate tubercle; at either side weak transverse carinae separating first and second segments; posterolateral angles with a subrectangular sclerite. Abdominal disc distinct and moderately elevated at middle, dorsal scent glands borne on a single longitudinal plate with distinct anterior dorsal abdominal scent gland opening displaced posteriorly, median and posterior scent gland openings progressively reduced but discernible; sublateral tergal plates of segment III divided by a distinct medial longitudinal suture, sublateral and lateral tergal plates all separated by distinct sutures. Connexivum slightly reflexed; connexival segments subquadrate at middle but with acute

posterolateral lobes increasing in size from third to fifth segments in male, the plates of second and third segments fused; spiracles on second, third and fourth segments ventral, remainder lateral. Pattern of glabrous areas distinct, conforming to the 2:1:1 type of Usinger & Matsuda (1959).

Undersurface smooth and polished on thorax and abdomen, without punctures or granules; collar distinct, pro-, meso-, and metasterna completely fused; metasternum and first visible abdominal ventrite fused, but suture discernible, other abdominal segments with distinct sutures. Legs with distinct glabrous trochanters, surface of legs granular, pretarsi with distinct pullvilli and parempodia (Goel & Schaefer 1969). Pattern of glabrous areas 2:2:1.

Male terminalia. Seventh abdominal tergite strongly elevated at middle. Eighth segment lobes distinctly angulate posteriorly, short, not nearly reaching apex of genital capsule, slightly angularly produced upwards and inwards. Pygophore enormously developed, produced dorsoposteriorly into two very large diverging subconical lobes with deep depression between, large median lobe directed ventrally.

Female terminalia. Seventh ventral segment a bilobed plate, each plate strongly obliquely carinate, about four and a half times as long as preceeding segment at middle. Eighth segment fully exposed across its width above, with lateral lobes not reaching tip of ninth segment, spiracles laterally positioned.

TYPE SPECIES. *Modicarventus wisei* sp.n.

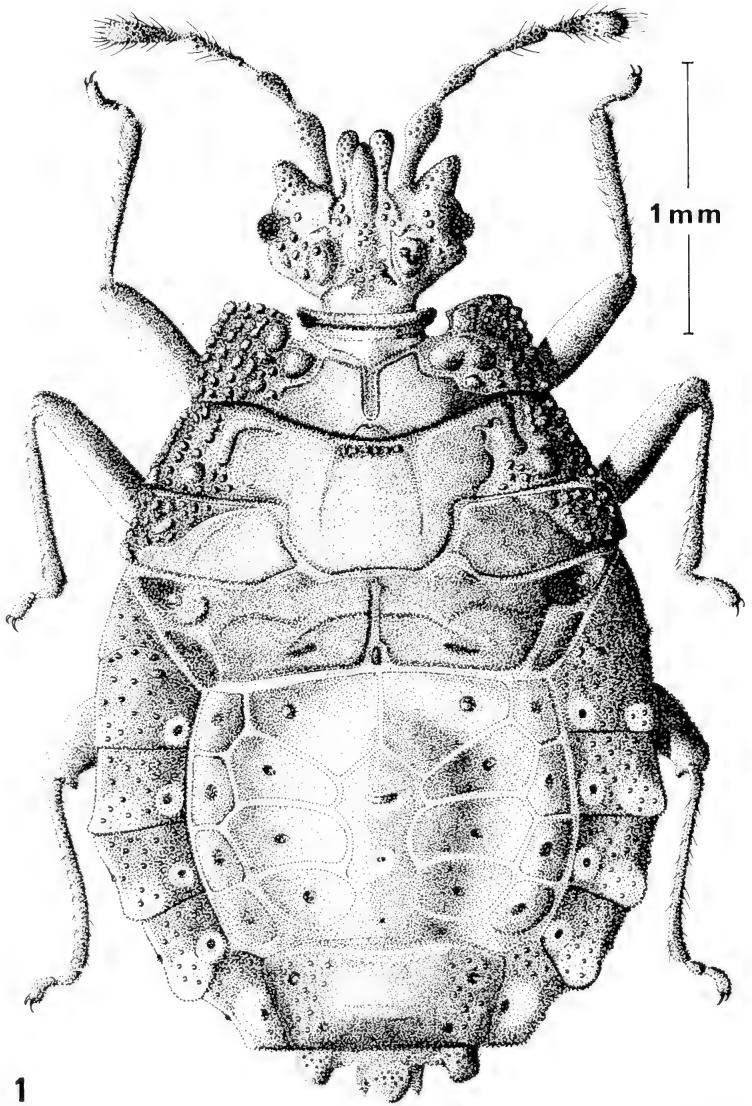
Derivation. Modi(cus), Lat = modest, + *Carventus.*

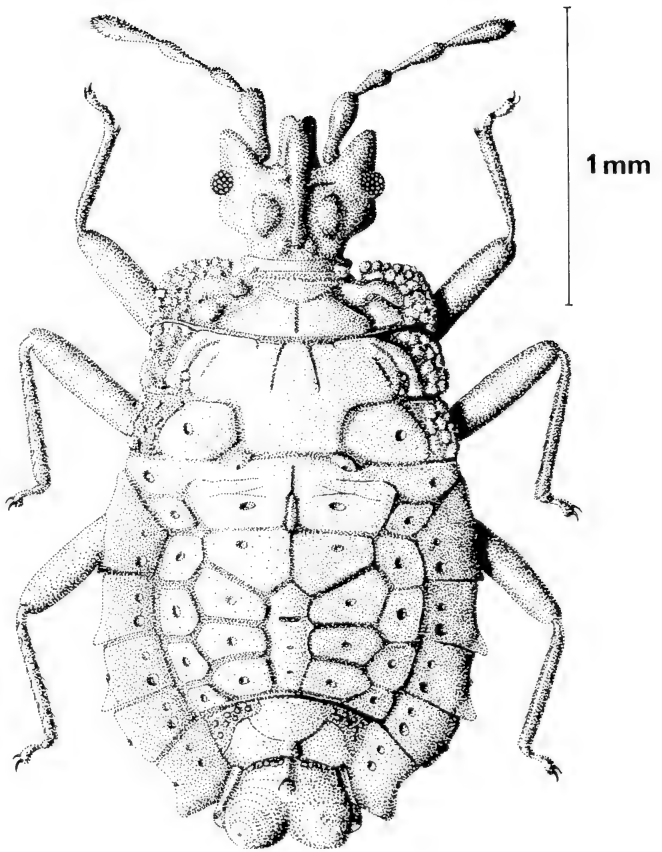
Modicarventus wisei sp.n. (Figs. 1-6)

Apterous.

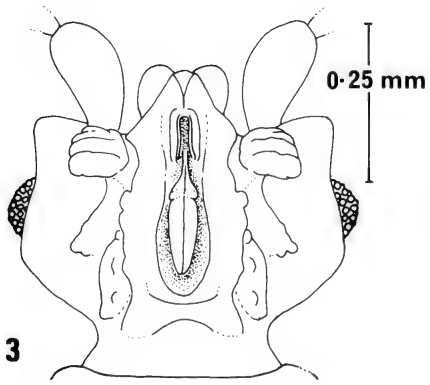
Head. Wider across eyes than long (male 0.60 : 0.47 mm, female 0.70 : 0.57 mm); anterior process reaching middle of first antennal segment; genae rounded at apices, extending beyond apex of clypeus, forming a narrow notch in front of the latter, finely granulate; antenniferous tubercles short, thick, outer margins subparallel in male, slightly divergent in female, finely granulate; postocular lateral margins of head subparallel then regularly narrowed to a constricted collar; pair of large laevigate suboval tubercles between median longitudinal ridge and postocular margins of head. Antennae about 1½ X as long as head, granulate, relative length of first to fourth segments 0.22 : 0.15 : 0.22 : 0.27 mm in male, 0.27 : 0.17 : 0.26 : 0.30 mm in female, first segment narrowed at basal one third, not granulate, then thickened anteriorly, apex rounded; second segment slightly curved at base, gradually thickened anteriorly, apex rounded; third segment pedunculate at base, then gradually thickened anteriorly, apex rounded, sparsely pubescent; fourth segment fusiform, sparsely pubescent. Rostral atrium with narrow slit. Rostrum short not reaching posterior margin of head, rostral groove widened at middle, glabrous on either side of groove (Fig. 3).

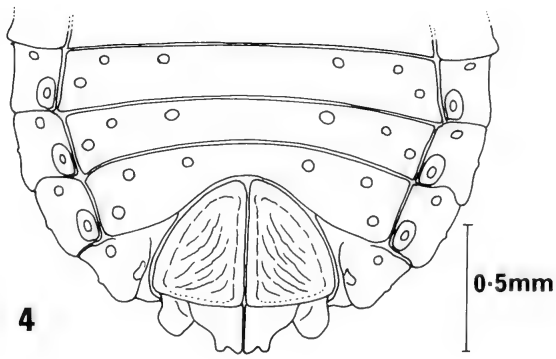
Thorax. Pronotum about 3 X as wide at base as long at middle including collar, (male 0.95 : 0.32 mm, female 1.15 : 0.37 mm), collar distinct, glabrous, ring-like, anterior margin curved slightly forward laterally, lateral extremities with a small tubercle, ring-like depression behind collar, posteriorly directed triangular plate immediately behind post-collar depression: anterior margin behind collar roundly incised then produced

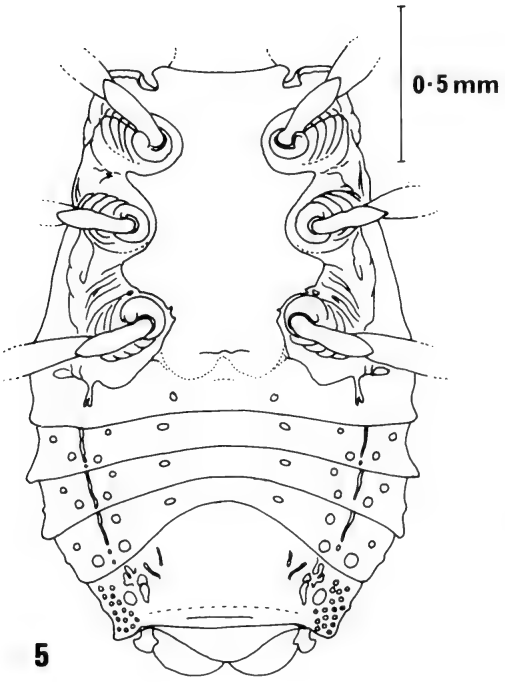


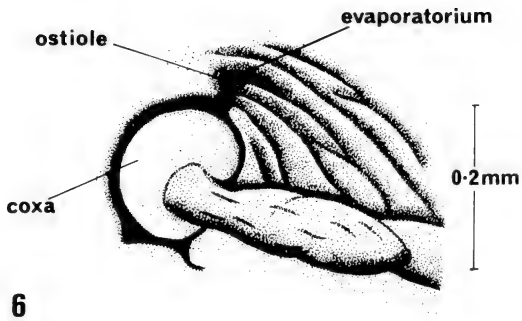


Figs. 1,2. *Modicarventus wisei* sp.n. 1. Female holotype. Dorsal. 2. Male allotype. Dorsal.









Figs. 3-6. *Modicarventus wisei* sp.n. 3. Male allotype. Head, ventral. 4. Female holotype. Terminalia, ventral. 5. Male allotype. Ventral. 6. Male. Metasternal scent gland.

anteriorly, anterolateral angles rounded, obtuse; lateral margins feebly convex; posterior margin sinuate, broadly produced posteriorly at middle: upper surface laevigate, glabrous on area surrounding median longitudinal groove, area lateral of collar with series of round granules extending from anterior to posterior margin: anterior, lateral, and posterior margins depressed and granulate, posterior suture distinct.

Mesonotum about 3 X broader than long (male 1.07 : 0.37 mm, female 1.37 : 0.45 mm); upper surface mostly a medially elevated glabrous plate, posteriorly produced into a subrectangular lobe reaching to basal abdominal tergites, occupying medial third of metanotum, anterior margin of this plate narrowly incised posteriorly forming an anteriorly directed medial lobe in male, lobe broader and with a granular anterior margin in female, plate extending laterally to occupy all but submarginal lateral area, lateral extremities of plate with broad anterior incisions from posterior margin; sublateral area with granules continuous with those of prothorax; lateral margins straight, granulate, posteriorly widened; posterior margin granulate, straight until contact with medial posterior lobe, then turning posteriorly to follow lobe margin; posterior suture distinct.

Metanotum divided into two segments by mesonotal lobe which occupies medial third; lateral margins rounded, granulate; inner portion of each segment with glabrous laevigate plate extending from near posterolateral angles to mid-point of anterior margin, outer portion with granules continuous with posterior margin of mesonotal lobe.

Abdomen. Widened at middle, relative width at posterior angles of third to sixth connexival segments 1.22 : 1.25 : 1.20 : 0.85 mm in male, 1.77 : 1.80 : 1.70 : 1.37 mm in female. First and second tergal segments fused, strongly elevated anteriorly, medial longitudinal depression extending from posterior margin almost to anterior margin, a straight longitudinal carina in posterior half of this depression in male, and a small elongate tubercle in near posterior margin in female: anterior margin broadly sinuate; extremities produced anteriorly, separating thoracic from connexival segments; posterior margin well defined from succeding segments by an anteriorly curved suture: upper surface with transverse ridges at either side of medial depression indicative of original segmentation, sclerite within posterolateral angle subcontiguous with lateral tergal disc sclerites. Tergal disc glabrous, medially elevated, anterior margin straight lateral margins rounded, posterior margin curved anteriorly; lateral markings distinct on segments III to VI, subrectangular, with central depressed oval spots; sublateral markings clearly separated from lateral markings, each with central depressed oval spots; median longitudinal axis bearing scent gland openings a single fused plate, anteriorly angularly produced, laterally rounded indented coincedently with sublateral markings of segments IV to VI; first reduced gland placed between sublateral patterns of segment IV, second and third glands vestigial placed between sublateral patterns of segments V and VI respectively. Connexivum granulate, not conforming to curvature of tergal disc, second and third segments fused, but suture line discernible in female, subsequent segments subrectangular, each with a pair of laevigate round tubercles, of which the posterior one is always the larger; in male posterior angles of third to fifth segments with angular lateral projections, sixth with no lateral projection; in female posterior angle of third segment with no lateral projection, fourth to sixth segments with lateral rounded lobes. Spiracles ventral on segments II, III, and IV, lateral on segments V, VI, and VII.

Male terminalia. Seventh tergal abdominal segment strongly elevated posteriorly to a medial tubercle, glabrous apart from subtriangular granulate areas in anterolateral angles. Seventh connexival segment with acute posterolaterally directed lobe behind spiracle. Ventrally seventh segment a broad glabrous plate about 5 X longer than preceeding segment at middle, laterally fused to connexival segment, sutures indistinct, connexival region strongly granulate, posterior margin with transverse carinae. Eighth segment lobes short, not reaching posterior margin of ninth segment, angularly produced upwards and inwards. Ninth segment large, broad, conspicuously divided into two divergent dorsoposteriorly directed subconical lobes with deep depression between, a broad rounded median lobe produced ventrally.

Female terminalia. Seventh tergal abdominal segment subrectangular but narrowing posteriorly, anterior margin sinuate, lateral and posterior margins straight, granules and callosities along lateral and posterior margins, median elevated area glabrous. Seventh connexival segment with posterior margin straight, conforming with seventh tergal segment, posterior angles obtuse. Ventrally seventh segment a bilobed plate strongly obliquely carinate, about 4½ X as long as preceeding segment at middle. Eighth segment conspicuously exposed across its width above, lateral lobes not reaching apex of ninth segment, spiracle on outer margin. Ninth segment broad, narrowing posteriorly, lateral margins sinuate.

Colour. Overall red-brown.

Measurements. All comprise single female, and mean of two males.
Length. Male 2.45 mm. Female 3.07 mm. Maximum width. Male 1.27 mm. Female 1.82 mm.

TYPE SPECIMENS. Holotype female. Unuwhao (North Cape area), forest remnant, P/S sample 218,22.II.1967, K.A.J. Wise (AMNZ). Allotype male and paratype male. Whareana (North Cape area), Taraire leaf-litter, forest remnant, P/S sample 399, 6.XII.1967, K.A.J. Wise (AMNZ).

Modicarventus is closely related to *Neocarventus* U. & M. in that they share some important characters, particularly the posteriorly directed mesothoracic lobe which divides the metathorax into two, and the large pygophore produced into two large lobes posteriorly and a large ventral lobe.

The major distinguishing features between *Modicarventus* and *Neocarventus* U. & M. are summarised below, with *Neocarventus* features bracketed.

1. Antennae. Fourth segment longest, second segment shortest, first and third segments subequal. (First segment longest, second segment shortest, third and fourth segments subequal).

2. Rostral margin glabrous. (Rostral margin obliquely rugose).

3. A distinct posteriorly directed subtriangular sclerite behind collar. (Absent).

4. Mesothoracic median lobe broad, occupying medial third of metanotum. (Mesothoracic median lobe subtriangular, forming a wedge-like division of the metanotum).

5. Metanotal lateral spines absent in male. (Well developed lateral spines in male).

6. Median longitudinal carina of basal tergites short, not extending into anterior half. (Carina extends from anterior to posterior margins of basal tergites).

7. No transverse suture across basal tergites, but subrectangular sclerites in posterolateral angles. (Well defined transverse suture laterally, no sclerites in posterior angles).

8. Sublateral tergal sclerites of segment III separated by median longitudinal suture. (Fused medially).

9. Tergal disc with scent gland openings borne on a single fused plate along the median longitudinal axis. (Median axis laterally fused with tergal patterns).

10. Male VIII segment lobes small, inwardly curved. (Male VIII segment lobes large upwardly curved spines, hook-like).

The species is named after Mr Keith Wise, Entomologist, Auckland Institute and Museum, as a token of my respect for his indefatigable efforts on behalf of New Zealand entomology, and, in appreciation for his encouragement of my work.

Acknowledgements. I should like to thank Mr K.A.J. Wise, of the Auckland Institute and Museum, for the loan of specimens, and Professor J.G. Pendergrast, Waikato University, Hamilton, for reading and discussing the manuscript.

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A REDESCRIPTION OF THE GENUS *NEOCARVENTUS* (HEXAPODA : HEMIPTERA : ARADIDAE) AND A DESCRIPTION OF A NEW SPECIES FROM NORTHLAND, NEW ZEALAND

M. KIRMAN

WAIKATO POLYTECHNIC, HAMILTON

Abstract: The genus *Neocarventus* Usinger and Matsuda, is redescribed and *Neocarventus uncus* sp.n. from leaf-litter in the Wharawara, Puketi, and Waipoua State Forests, Northland, New Zealand is described and figured.

Specimens of this new species of Carventinae (Hemiptera : Aradidae) were encountered while determining aradids from leaf-litter samples in the collections of the Entomology Division, DSIR, Auckland (NZAC), and the Auckland Institute and Museum (AMNZ). This remarkable bug, although clearly *Neocarventus* differs in many significant respects from *N. angulatus* Usinger & Matsuda, particularly in the enormous development of the metathoracic spines in the male, and in the most distinctive arrangement of tergal disc sclerites in both sexes. Usinger and Matsuda's (1959) characterisation of the genus *Neocarventus* was based upon two male specimens of *N. angulatus*. The discovery of an additional species has necessitated some revision of the definition. A more flexible definition, incorporating female characters is given.

Prior to description, the pale incrustation, characteristic of the Carventinae, was removed using a fine mounted needle.

The holotype and allotype are deposited in the New Zealand Arthropod Collection, Entomology Division, DSIR, Mount Albert, Auckland.

Family ARADIDAE

Subfamily CARVENTINAE (Usinger, 1950)

Genus **Neocarventus** Usinger & Matsuda, 1959

Changes from Usinger and Matsuda's original description are indicated by italics.

Apterous. *Elongate oval to subrectangular in body form.* Surface with a thin pale incrustation, particularly extensive on head, thoracic sutures and connexival segments.

Head about as wide as long; eyes small; anterior process prominent, the clypeus narrowing apically, with thick genae exceeding apex and forming a small cleft. Antenniferous tubercles short, blunt, conical. Postocular region of head not exceeding lateral margin of eyes; neck constricted. Antennae longer than head, but not excessively long; *first segment longest exceeding apex of head by half its length, second segment shortest, third and fourth segments subequal.* Rostrum slender, especially near base, arising from a closed atrium well behind apex of clypeus.

Pronotum distinctly shorter then head, collar dorsally distinct, ring-like, with a lateral tubercle, with a ring-like depression behind; disk deeply impressed behind this: hind margins produced into a short triangular projection posteriorly, anterior margin subcontiguous with tubercles on collar; anterior angles obtuse; lateral margins flaring posteriorly and produced as acute lobes.

Mesonotum *as long or slightly longer at middle as pronotum,* produced prominently backwards into a medial acute lobe *reaching or almost reaching the anterior margin of the basal abdominal segments: anterior margin incised posteriorly forming an anteriorly directed median lobe:* lateral margins flaring posteriorly and produced as *acute lobes.*

Metanotum divided into two by the mesonotal lobe, *strongly produced posterolaterally into distinct elevated spines in male, and rounded lobes in female.*

Basal abdominal tergites strongly elevated anteriorly, *fused medially, at either side a distinct transverse suture separating first and second segments.* Abdominal disc distinct and moderately elevated at middle; with distinct anterior dorsal abdominal scent gland opening displaced posteriorly; median and posterior scent gland openings progressively reduced but discernible.

Connexivum slightly reflexed; connexival segments subquadrate at middle, the plates of second and third segments fused, reaching forward to hind angles of metanotum: *spiracles on second, third and fourth segments ventral, remainder lateral. Pattern of glabrous areas distinct, conforming to the 2:1:1 type of Usinger & Matsuda (1959).*

Undersurface smooth and polished on thorax and abdomen, without punctures or granules, collar distinct, pro-, meso-, and metasterna completely fused: metasternum and first visible abdominal ventrite fused but suture discernible, other abdominal segments with distinct sutures. Legs with distinct glabrous trochanters, surface of legs distinctly granular: *pretarsi with distinct pulvilli and setose parempodia (Goel & Schaefer 1969). Pattern of glabrous areas 2:2:1*

Male terminalia. Seventh abdominal tergite strongly elevated at middle. Eighth segment lobes distinctly angulate posteriorly, short, not nearly reaching apex of genital capsule, produced upwards and outwards as curved spines. Pygophore enormously developed, produced posteriorly into two very large rounded lobes with deep depression between, a large median lobe is directed ventrally.

Female terminalia. Seventh ventral segment a bilobed plate, each plate strongly obliquely carinate; about three times as long as preceeding segment at middle, seventh connexival segment with conspicuous lobes. Eighth segment fully exposed across its width above, with lateral lobes not reaching tip of ninth segment, spiracles laterally positioned.

TYPE SPECIES. *Neocarventus angulatus* Usinger & Matsuda.

Neocarventus uncus sp. n. (Figs. 1-5)

Head. About as long as wide across eyes (male 0.67 : 0.70 mm, female 0.72 : 0.75 mm); anterior process reaching middle of first antennal segment; genae rounded at apices, extending beyond apex of clypeus, forming a narrow notch in front of the latter, finely granulate: antenniferous tubercles, short, thick, directed slightly laterad, apices acutely rounded; eyes located distinctly in front of middle of lateral margins of head; postocular lateral margins briefly subparallel then regularly narrowed posteriorly, coarsely granulate; a pair of large laevigate suboval tubercles on either side of posterior median longitudinal ridge. Antennae about 1½ X as long as head, granulate; relative length of first to fourth segments 0.31 : 0.20 : 0.28 : 0.30 mm (both sexes), first segment narrowed at basal one third, not granulate, then equally thickened anteriorly, apex rounded; second segment slightly curved at base, gradually thickened anteriorly, apex rounded; third segment pedunculate at base, then gradually thickened anteriorly, apex rounded; fourth segment fusiform, sparsely pubescent. Rostral atrium with a narrow slit. Rostrum short, not reaching posterior margin of head; rostral groove widened at middle, coarsely granulate on either side of groove (Fig. 2).

Thorax. Pronotum about 2½ X as wide at base as long at middle including collar, (male 1.10 : 0.42 mm, female 1.20 : 0.47 mm); collar distinct, glabrous, ring-like, lateral extremities with a large tubercle on dorsal surface; ring-like depression behind collar; upper surface glabrous, continuous with median longitudinal groove which does not reach the posterior margin; anterior margin straight but rectangularly incised on either side of collar; anterolateral angles obtuse; lateral margins straight; posterior margin broadly roundly produced posteriorly at middle; posterior angles acute; upper surface with laevigate glabrous subtriangular plates at either side of longitudinal groove, posteriorly medially united in female, with further laevigate glabrous subovoid callosities extending transversely to near lateral margin; anterior, lateral and posterior margins depressed and granular.

Mesonotum about 3 X broader than long (male 1.35 : 0.42 mm, female 1.52 : 0.47 mm), with a large medial glabrous elevated and posteriorly directed subtriangular plate extending from anterior margin to touch the posterior margin of metanotum, anterior margin of this plate incised posteriorly forming an anteriorly directed median lobe; anterior margin curved anteriorly from middle; suture between mesonotum and pronotum deep; lateral margins sinuate, granular, flaring posterolaterally to very acute posterior angles; posterior margins straight, granular, until connecting with large median lobe; upper surface with granules and callosities.

Metanotum divided by median mesonotal lobe; lateral margins with remarkable large elevated, granular, posterolaterally directed spines in male, small rounded lobes in female; anterior margins straight, then depressed along median projection of mesonotum, posterior margin strongly elevated medially, broadly sinuate.

Abdomen. Narrowing posteriorly in both sexes, relative width at posterior angles of third to seventh connexival segments 1.52 : 1.52 : 1.40 : 1.22 : 1.17 mm in male, 1.95 : 1.92 : 1.80 : 1.60 : 1.22 mm in female. First and second tergal segments fused, strongly elevated anteriorly, depressed at middle, with a straight medial longitudinal carina extending from anterior to posterior margins; anterior margin broadly sinuate, extremities produced anteriorly separating thoracic from connexival segments; posterior margin well defined from succeeding segments by a deep anteriorly curved suture; upper surface with distinct transverse suture on either side of medial depression extending to a deep pit near lateral extremity, anterior to this suture an

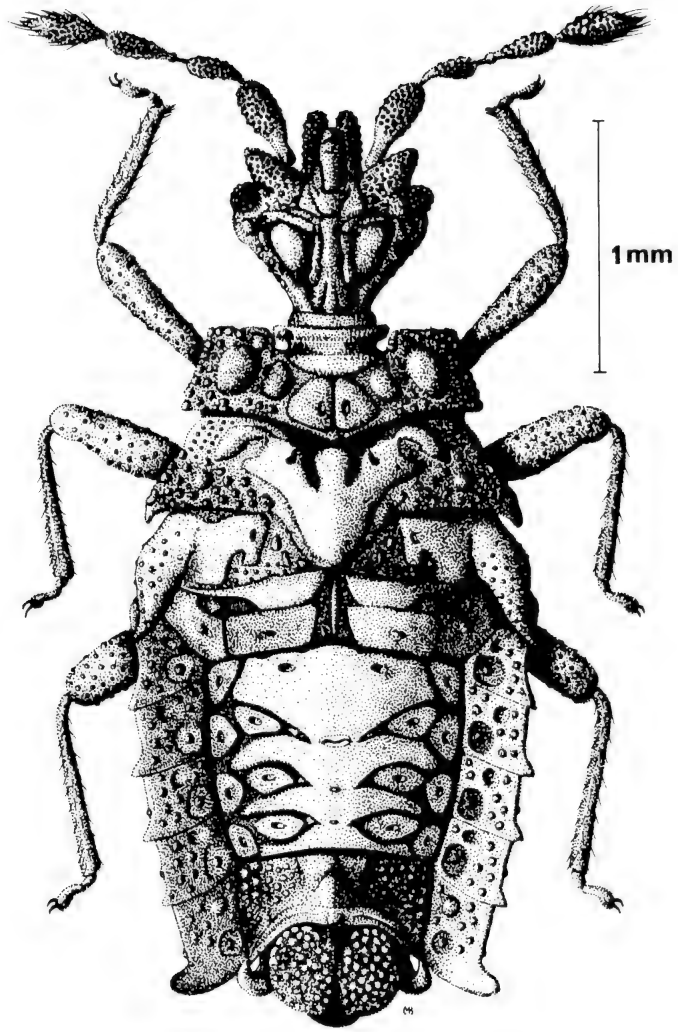
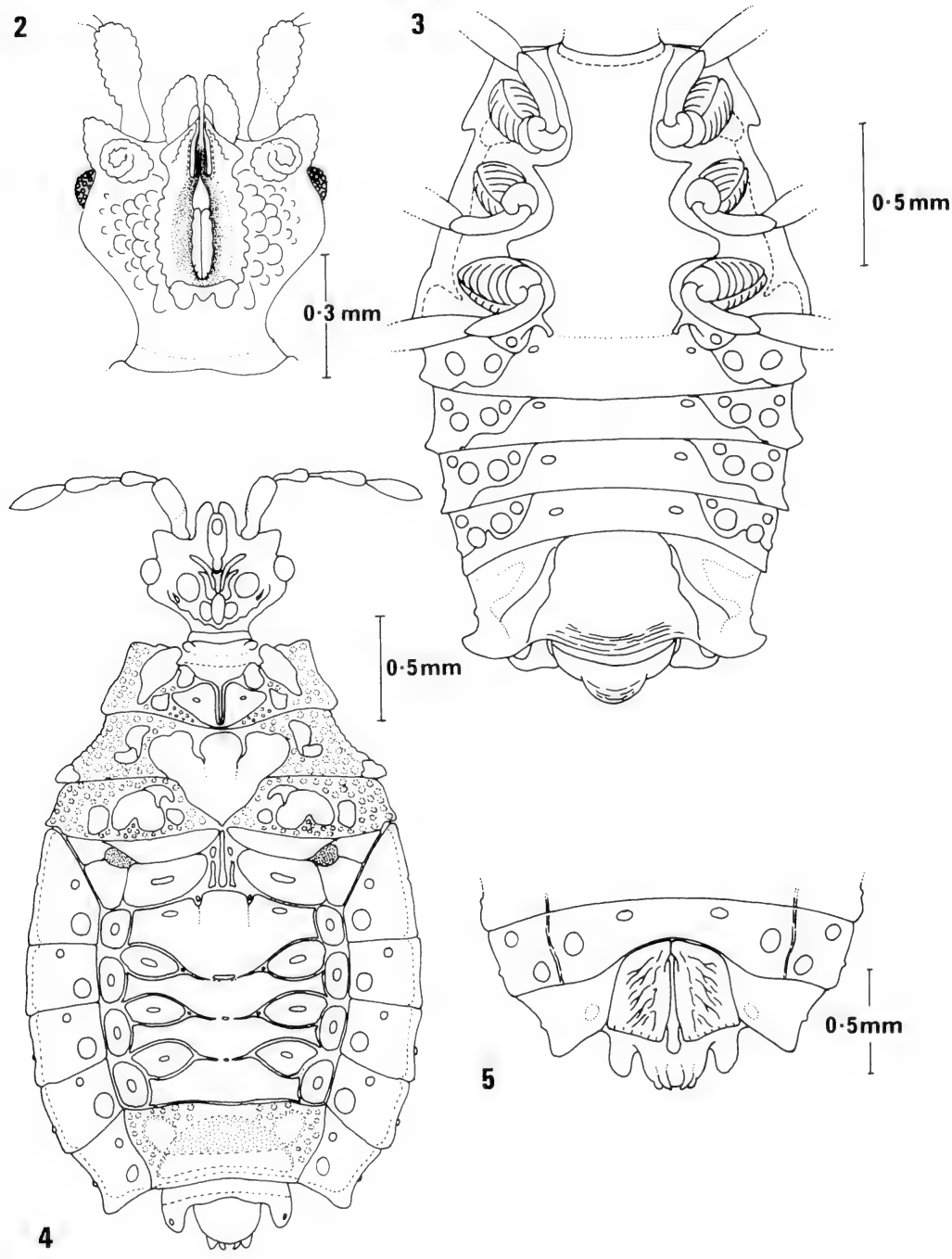


Fig. 1. *Neocarventus uncus* sp.n. Male holotype. Dorsal.

elongate laevigate glabrous tubercle, posteriorly with a subrectangular laevigate glabrous plate. Tergal disc (Usinger & Matsuda 1959) glabrous, medially elevated, lateral row of tergal patterns well defined from each other, each with a medial oval depression; sublateral tergal patterns distinct on segments IV to VI, angular in male, oval in female, each with medial oval depression, sutures, narrow in female, terminating adjacent to medial scent gland openings; first reduced gland placed between second sublateral tergal patterns, second and third glands vestigial, placed between third and fourth sublateral tergal patterns respectively; anterior margin with anteriorly directed small median lobe, well defined from preceeding segments by a deep suture; posterior margin sinuate with deep suture. Connexivum reflexed, granulate, second and third segments fused, subsequent segments subrectangular, each with a pair of laevigate round tubercles, of which the posterior is always the larger; posterior angles of third to sixth segments with angular lateral projections in male, rounded in female.



Figs. 2-5. *Neocarventus uncus* sp.n. 2. Male holotype. Head, ventral. 3. Male holotype. Ventral. 4. Female allotype. Dorsal. 5. Female allotype. Terminalia, ventral.

Male terminalia. Seventh tergal abdominal segment in male very strongly elevated posteriorly and medially, subrectangular glabrous area extending medially from anterior to posterior margin, remaining area with granules and callosities, ventrally, a broad subrectangular glabrous plate, elevated posteriorly (Fig. 3). Seventh connexival segment with large strongly elevated rounded lobe behind spiracle, extending beyond eighth segment lobes, with rounded tubercles conforming with other connexival segments. Eighth segment lobes strongly developed into dorsolaterally curved spines beyond lateral spiracle. Ninth segment large, broad, strongly granulate, conspicuously divided into two posteriorly directed lobes with deep depression between, a rounded median lobe produced ventrally.

Female terminalia. Seventh tergal abdominal segment subrectangular, but narrowing posteriorly, anterior and lateral margins sinuate, posterior margin slightly rounded anteriorly; medially elevated, with complex pattern of fine granules and glabrous areas, but with large granules along lateral third of anterior margin and lateral margin; posterior margin with transverse carinae. Seventh connexival segment with slight rounded lateral lobe behind spiracle. Ventral bilobed plate about 3 X as long as preceeding segment at middle, each lobe strongly obliquely carinate (Fig. 5). Eighth segment conspicuously exposed across its full width above, with inwardly curved lobes bearing spiracles on lateral margins, not reaching apex of ninth segment. Ninth segment strongly narrowed posteriorly.

Colour. Overall ferruginous red: tubercles on collar, margin of mesonotal lobe, posterior basal tergites, and dorsal scent gland area on tergal disc, all deep brown to black: mesonotal lobe, and posterior basal tergite, pale brown to yellow.

Measurements. All comprise means of 9 males, 4 females.
Length. Male 3.2 mm. Female 3.91 mm. Maximum width. Male 1.53 mm. Female 1.95 mm.

TYPE SPECIMENS. Holotype male. Wharawara State Forest, Northland, ex rotten log, 10.X.1974, J.C. Watt (NZAC). Allotype female. Same data as holotype (NZAC). Paratypes, 8 males, 1 female. Same data as holotype (NZAC).

Additional paratypes. Puketi S.F., Northland, litter 1 male, 21.I.1972, G.W. Ramsay (NZAC). Waipoua S.F. 1km E of HQ. 1 male, 15.IV.1980, J.C. Watt (NZAC). Mt. Camel Peninsula, valley W. side, Mangonui Co, P/S sample 1399 1 female, P/S sample 1401, 1 male 1 female, 20.X.1982, K.A.J. Wise & R.F. Gilbert (AMNZ).

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A REVISION OF THE GENUS MIMOPEUS (TENEBRIONIDAE) PART II

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Abstract. This paper is part II of a revision of the genus *Mimopeus*. Part I was published in *Rec. Auckland Inst. Mus.* 25:95-146 and includes a key to species on pp.117-120. Part II contains redescriptions of previously described species and full synonymies are listed. It also includes a section of Biogeography and Ecology. References to Figs. 1-105 in this text are to figures published in Part I, as are Tables 1-4. The redescribed species are *M. elongatus, M. pascoei, M. opaculus, M. buchanani, M. humeralis, M. thoracicus, M. lateralis, M. granulosus, M. subcostatus, M. costellus, M. impressifrons, M. tibialis, M. rugosus.*

The first part of this paper (Watt 1988) comprises a description of the genus *Mimopeus*, a key to species and descriptions of nine new species. Part II contains redescriptions of described species and a critical review of previously published data, together with a discussion of the biogeography and ecology of the genus.

Figure and Tables numbers are continued from the first part. References are as given previously together with those given here.

REDESCRIPTIONS OF SPECIES

Mimopeus elongatus (Brême, 1842) (Figs. 3,4,7,17,25,30)

elongatus Brême, 1842, Mon. des Cossyphides p.38, p1 VII, fig.6 (*Cilibe*); Watt, 1968, NZ Ent. 4(1):39 (*Mimopeus*); Watt, 1982, J. R. Soc. N.Z. 12(3):304.
amaroides Pascoe, 1866, J. Ent. 2:477; Bates, 1873, Ann. Mag. Nat. Hist. (4) 12:474 (*Celibe*).
granulipennis Bates, 1873, Ann. Mag. Nat. Hist. (4) 12:479 (*Cilibe*); Broun, 1880, Man. NZ. Col. 1:375 (*Cilibe*).
huttoni Sharp, 1878, Ent. Mon. Mag. 15:51 (*Cilibe*); Broun, 1880, Man. NZ. Col. 1:378-9 (Cilibe); Hudson, 1934, NZ Beetles p.88 (*Cilibe*).
marginalis Broun, 1893, Man. NZ. Col. 5:1155 (Cilibe).
meridionalis Sharp, 1903, Ent. Mon. Mag. 39:109 (*Cilibe*).
phosphugoides White, 1846, Voy. Ereb. Terr. Ins. p.11 (*Cilibe*); Blanchard, 1853, Voy. Pol. Sud. 4:150 (*Cilibe*); Bates, 1873, Ann. Mag. Nat. Hist. (4) 12:478 (*Cilibe*).

Elongate oval, convex (Fig. 3), colour reddish brown or reddish black, undersurface shining reddish brown to reddish black.

MALE

Dorsal surface. Antennae similar to Fig. 7, basal segments covered with fairly stout semi-erect setae, which become shorter and finer towards the apex. Terminal three segments bearing fine, whitish pubescence, microsculpture of surface strong and irregular, clearly visible at 25 x magnification; other segments shining, microsculpture visible at 100 x magnification.

Labrum emarginate, finely punctate, each puncture bearing a moderately long yellow seta.

Head similar to Fig. 3, eyes generally extending slightly further laterally than genae. Clypeus emarginate anteriorly, clypeal sutures indistinct, frons slightly depressed behind clypeus. Upper surface of head finely punctured, punctures shallow, with gently sloping sides, interstices smooth, bearing some small micropunctures just visible at 100 x magnification, microsculpture weak, visible at 100 x magnification. Punctures become smaller towards front and lateral margins of head.

Pronotum (Figs. 3,17) moderately convex, individually variable in shape, sometimes without the sinuation before the posterior angles, when distance across posterior angles is less. Punctures of pronotum small and shallow, with gently sloping sides, sparse on disc, separated by more than twice their own diameter, more closely set towards base and marginal channels. Micropunctures barely visible at 100 x magnification. Interstices smooth and shining, microsculpture weak, visible at 100 x magnification; a few small raised dome-shaped granules present in submarginal channels.

Scutellum triangular (Fig. 3), relatively large, transverse, very finely punctured, punctures shallow, almost imperceptible at 25 x magnification; no micropunctures visible, even at 100 x magnification.

Elytra (Fig. 3) convex, elongate oval, lateral and hind slopes steep, submarginal channel very narrow, obsolete posteriorly, epipleural carina thickened but not upturned. Suture plane, first and second primary costae broad and raised at base, becoming obsolete on disc. There is a linear system of longitudinal ridges and furrows, very indistinct, and just visible with oblique lighting. Punctures small and shallow, mostly separated by at least twice their own diameter; micropunctures about one third the diameter of macropunctures. Interstices uneven, microsculpture very strong, visible at 25 x magnification, many small shiny granules present over whole surface, some surrounding small punctures.

Ventral surface. Mentum (Fig. 4) finely punctate. Pregular region of postgenae with fine, shallow punctures, gular region with very fine punctures in laterally elongate depressions, ridges between these bearing some very small shining granules. Gula smooth, shining, with some fine punctures just visible at 25 x magnification.

Prosternum bearing fine, shallow punctures, mostly separated by more than 3 x their own diameter, interstices smooth except laterally, where there are some small granules. Intercoxal process curving upwards posteriorly, with a slight concavity before the hind slope, submarginal grooves shallow, narrow and indistinct, marginal ridge wide. Sculpture of proepimeron like prosternum, but punctures even finer.

Mesosternal intercoxal process (Fig. 30) relatively broad, median part not very convex, marginal ridges and submarginal grooves narrow. Mesosternum, mesepisternum and mesepimeron very finely and rather sparsely punctate, interstices smooth, shining, each puncture bearing a fine yellow seta. Metasternum and metepisternum with similar sculpture.

Abdominal sternites finely and sparsely punctate, shining, slightly longitudinally rugose, setae of median area very short, longer towards sides. Distinct submarginal grooves present on visible sternites 2, 3, 4 and 5.

Epipleura of elytra very finely and sparsely punctured, interstices shining but bearing microsculpture visible at 25 x magnification, and some small granules.

Legs. Femora smooth, shining, very finely punctate, each puncture bearing a fine, relatively long yellow seta. Tibiae with larger punctures than femora, yellow setae much stouter,

interstices smooth and shining. Upper surface of basal tarsal segments bearing fairly stout yellow bristles at their apices, terminal segment bearing finer setae, microsculpture of most of upper surface strong, visible at 25 x magnification. Undersurface of tarsi clothed densely with long yellow setae.

Aedeagus (Fig. 25). Relatively stout. In dorsal view apicale broad at base, tapering slightly sinuately to apices of parameres, which are subacuminate. Apex of basale as wide as base of apicale, becoming gradually broader till just before base. Surface of parameres with a few very small punctures. In lateral view, apicale wedge-shaped, basale convex, barely curved downwards at base.

FEMALE

Like male, but legs shorter and more slender, often difficult to distinguish without dissection.

DIMENSIONS

Range. Length 10.9-14.9 mm, width 5.3-7.3 mm.

GEOGRAPHICAL VARIATION

Generally speaking, populations lacking pronotal granules or with these weakly developed, and with weak pronotal microsculpture, inhabit the vegetated dunes of sandy beaches. Those with strong microsculpture and well-developed granules live under stones amongst *Muhlenbeckia complexa* (on boulder beaches, or above rocky shores on islands, or in the craters of some of Auckland's extinct volcanoes). There are intermediate populations on the mainland, and the variation in these as in other characters is clinal. Geographical variation occurs also in size and depth of macropunctures and micropunctures on various sclerites; development of granules on elytra, prosternum, epipleura and front tibia; development of transverse ridges on postgenae; body size and shape, and shape of head and pronotum; shape and size of the aedeagus; form of the intercoxal processes; length and stoutness of setae of the underside; and shape of the terminal antennal segment.

M. elongatus extends around the coast of the North I but in the Cook Strait area it is replaced by *M. neglectus*. In the Auckland area, west coast populations are quite distinct from east coast populations. If the species is followed north from Auckland round the coast of Northland, east and west coast populations merge into each other (approximating to a "ring species" Watt 1982).

TYPE MATERIAL. Lectotype of *elongatus* Brême ♂ 11.4 x 5.5 mm Torino. The type series comprises 4 specimens ♂ & 3 ♀, fairly uniform probably from one population. All have weak pronotal microsculpture, with granules confined virtually to marginal channels. Lectotype ♂: N. le Guinée [Brême]/ [small black triangle]/ LECTOTYPE ♂. Cilibe elongatus Brême det J.C. Watt, 1985 (Mimopeus). Some sand grains are adhering to the specimen ventrally.

Paralectotype ♀ with same original data as lectotype.

Paralectotype ♀ with no original labels but standing over same cabinet label as lectotype.

Paralectotype ♀? [head and abdomen lacking] bearing a small black triangle. Beneath the type specimen is another cabinet label "C. elongatus" above which are dissected mouthparts and antenna. These presumably belong to this last specimen. Below the cabinet label of *C. granulosus* are 3 specimens of *elongatus*, the first of

which bears the label: Selenepistoma australasica mihi N. Zealand [Brême]. This is apparently an unpublished manuscript name.

Lectotype of *amaroides* Pascoe 12.8 x 6.4 mm BMNH. Lectotype (sex not determined, abdomen missing). LECTOTYPE [printed, in purple circle]/ Australia [Pascoe on green oval label]/ Pascoe Coll., 93-60 [printed]/ LECTOTYPE, Mimopeus amaroides Pasc = elongatus (Brême), Det. J.C. Watt, 1985.

There is a second specimen of this species from the Pascoe Collection labelled: Cilibe elongata de B, Australia [Pascoe]. It hardly seems justsified to regard this specimen as a syntype of *M. amaroides* in view of the determination label by Pascoe, but agrees well with his description. No other specimens have been seen which could be syntypes of *M. amaroides*. Perhaps Pascoe realised that *amaroides* is a synonym of *elongatus* before his collection went to BMNH and removed the det. label — alternatively, he may never have labelled it. The locality Australia is, of course, erroneous.

The published type locality is "Australia". The specimen here designated as lectotype is con-specific with typical NZ specimens of *M. elongatus*.

Holotype of *granulipennis* Bates ♀ 11.4 x 5.6 mm New Zealand BMNH. Holotype ♀. Type [printed in red circle]/ Cilibe elongata *var.* granulipennis (type) F. Bates [Bates].

Lectotype of *huttoni* Sharp ♀ 11.2 x 5.5 mm BMNH. Lectotype ♂ [pinned, aedeagus on card]: LECTOTYPE [printed in purple circle]/ Cilibe huttoni ♀. Type D.S. Otago, Hutton 1877 [Sharp]/ Sharp Coll., 1905-313 [printed]/ LECTOTYPE ♂, Cilibe huttoni Sharp (= Memopeus elongatus (Brême), det. J.C., Watt, 1985.

Paralectotype 2 ♀ with same original data as lectotype except "♂", BMNH.

Paralectotypes 3♂, 5♀ with same original as lectotype but with "Ind. type" instead of "Type", BMNH.

Holotype of *marginalis* Broun ♂ 11.1 x 5.4 mm BMNH. Holotype ♂: Type [printed in red circle]/ 2047/ Cilibe marginalis [Broun]/ New Zealand Broun Coll. Brit. Mus. 1922-482 [printed]/ Mokohinau [printed]/ HOLOTYPE ♂, Cilibe marginalis Broun = Mimopeus elongatus, det J.C. Watt, 1985.

Lectotype of *meridionalis* Sharp ♂ 11.3 x 5.0 mm BMNH. Lectotype ♂: Type [printed in red circle]/ Cilibe meridionalis. Type D.S. Waikawa Bay, Schauinsland [Sharp]/ Sharp Coll., 1905-313 [printed]/ LECTOTYPE ♂. Cilibe meridionalis Sharp = Mimopeus elongatus (Brême), det J.C. Watt, 1985. The lectotype, which is light reddish-brown in colour, appears to be teneral.

Holotype of *phosphugoides* White BMNH ♂ 13.0 x 6.4 mm BMNH. Holotype ♂: Type [printed in red circle] 43 70. Cilibe phosphugoides. White, Zool. Erebus and Terror [White]/ HOLOTYPE ♂, Cilibe phosphugoides White = Mimopeus elongatus, det. J.C. Watt, 1985.

TYPE LOCALITY. There is no published type locality in either Brême's or Bates' publications on this species. The type specimen in Turin is very similar to Otago populations of *M. elongatus* described as *Cilibe huttoni* Sharp. Blanchard (1853) states that *elongata* was collected on Vavao Island, Tonga. Bates (1873) states that "It is doubtless in error that De Brême has reported this species as from New Guinea" and gives New Zealand as its habitat. All later writers, including the present, agree with Bates. Recent collecting by New Zealand entomologists in New Guinea and Tonga have failed to disclose the presence of any species of *Mimopeus* in either country.

In 1840, the ships *Astrolabe* and *Zelée* under Dumont d'Urville visited only Hoopers Inlet on Otago Pen., Akaroa on Banks Pen. and the Bay of Islands (Dunmore 1969).

Material examined. Types as listed above and 490 other specimens.

Murimotu I North Cape, Doubtless Bay, Coopers Beach, Cavalli Is, Whangaruru South, Ocean Beach, Whangarei Heads, Whangarei, Ruakaka Beach, Poor Knights Is, Hen and Chicken Is, Mokohinau Is, Pakiri Beach, Matakana.

Bethells Beach, Muriwai Beach, Pararaha Beach, Raglan, Awakino Beach.

Takapuna, Mt Eden, Auckland Domain, Freemans Bay, Mt Wellington, Epsom, Mt Albert, Wattle Bay, Mt Mangere crater, Ligars Bush Papakura, Riverhead, Hunua, Orua Bay, Rangitoto I, Motuihi Is, Horuhoru I (Gannet Rock), Noises Is (David Rocks, Otata I, Motuhorupapa), Little Barrier I, Gt Barrier I, (Port Fitzroy, Whangapoua Beach, Medlands Beach, Tryphena, Okupa), Cuvier I.

Wilsons Bay, Amodeo Bay, Te Hope, Pt Jackson, Mercury Is (Green I), Mercury Bay, Tairua Beach, Rat I, Coromandel Harbour.

Waihi Beach, Tauranga, Mt Maunganui, Omanu Beach, Papamoa Beach, Omapu Bay Mayor I, Rotorua Lake shore, Oruaiti Beach (near Waihau Bay), Hicks Bay, Terehunga, Opotiki.

Waitarere, Waitarere Beach, Manawatu, Castlecliff (Wanganui), Kapiti I, Pukerua Bay, Titahi Bay, Stephens I, D'Urville I, Trio Is, The Sentinel, The Twins (Queen Charlotte Sound), Brothers Is, Nelson, Kohiahia River, Oparara Beach, N. Karamea Beach, Charleston (Greymouth), Greymouth, Hokitika.

Waikouaiti, Dunedin, Sealers Bay (Codfish I off Stewart I).

Distribution and Ecology. North Island from North Cape to East Cape and on the west coast, usually in coastal habitats. This species is almost invariably found under *Muhlenbeckia complexa*, but has been found also under marram grass, *Spinifex* and *Cassinia*. Adults have been observed to feed on the bark and small roots of *Muhlenbeckia complexa* in captivity, while larvae feed on small roots. Whether they feed thus in nature, or only on vegetable debris beneath the plants under which they live, is not certain at present. It occurs also in the South Island from Cook Strait islands to Hokitika and from Stewart I to Otago.

Watt, in his thesis (1961), treated the synonymous names *meridionalis*, *huttoni* and *marginalis* as geographical subspecies of this species located respectively in Southland, Otago and the North Island. As each subspecies is linked by intermediate populations showing gradual clinal geographical variation, it is now thought undesirable to recognise the subspecies by trinominal nomenclature. If necessary they can be defined by locality without overloading formal nomenclature. However, *Cilibe meridionalis* was described from Waikawa which was thought to be the locality of this name in Southland, on the south coast of the South I, but it is now recognised as being

Waikawa Bay near French Pass north-east of Nelson, on the South I north coast, as pointed out by Alfken (1904: 593). *Cilibe marginalis* was originally recorded from Mokohinau Island but the type is identical with North I west coast individuals of *Mimopeus elongatus* (not recognised nomenclaturally by Broun).

Mimopeus pascoei (Bates, 1873) (Figs. 22,33,34,36,37,42-45)

pascoei Bates, 1873, Ann. Mag. Nat. Hist.(4)13: 479-80 (*Cilibe*); Broun, 1880, Man. N.Z. Col. 1: 372 (*Cilibe*); Watt, 1968, N.Z. Ent.4(1): 39 (*Mimopeus*).

Most closely related to *M. elongatus* and *M. turbotti*. Readily distinguished from *elongatus* by its broader and usually larger form, the deeper submarginal grooves within the elytral epipleural carina, extending almost to the elytral apices, and the aedeagi (Figs. 33,34,36,37) differ from any of the forms exhibited by *elongatus* (Figs. 25-28), the basal half of the basale being not expanded. Readily distinguished from *M. turbotti* by the rather less expanded lateral pronotal flanges, more distinct elytral submarginal channels, and the structure of the aedeagus.

Shows certain fairly strong similarities to species of the *humeralis* superspecies, especially in *subcostatus* which is a good species. Distinguished from all members of this complex (i.e., *M. thoracicus*, *vallis*, *parvus*, *humeralis* and *parallelus*) by the broad submarginal channels, and almost foliate lateral expansions outside them, of the pronotum; broader elytral submarginal channels; and broadly rounded elytral shoulders. The resemblances of *M. pascoei* to *M. elongatus* and *M. turbotti* are stronger and more important than those of *M. pascoei* to species of the *humeralis* superspecies.

MALE

Form moderately broad and convex. Colour dull black or reddish black, legs, antennae and underside shining reddish black.

Dorsal surface. Antennae as in *M. elongatus* but relatively shorter, terminal segment as broad as long, the two preceding segments transverse, remainder longer than broad. All segments clothed with yellow pubescence which become denser towards apex, segments 2-6 with stouter hairs apically. Form of head as in *M. elongatus* but broader, epistomal sutures usually distinct, sometimes obsolete. Labrum as in *M. elongatus*. Punctation of upper surface of head as in *M. elongatus*, micropunctures and microsculpture indistinct except on vertex.

Pronotum rather variable in shape, usually with a very slight sinuation before the posterior angles, lateral flanges moderately developed. Microsculpture strong, clearly visible at 25 x magnification, punctation of disc sparse, closer towards and in submarginal channels, most macropunctures of disc separated by more than 2 x their own diameter. Interstices without granules, smooth except in submarginal channels. Usually with a faint median longitudinal ridge running forwards from the base for a short distance.

Scutellum smooth, finely and sparsely punctate medially, punctures closer laterally, microsculpture visible at 25 x magnification.

Elytra moderately convex, costae almost obsolete, marked chiefly by rows of deeper punctures between them, macropunctures small, not steep-sided, separated by more than twice their diameter on disc, micropunctures very small barely visible at 25 x magnification. Epipleural carina raised slightly above submarginal channels from shoulder almost to apex. Shoulder broadly rounded.

Ventral surface. Head approximately as in *M. elongatus*, but smooth area of submentum rather narrower. Surface of prosternum bearing small granules laterally, and some very fine punctures elsewhere, microsculpture fairly strong. Proepisternum impunctate but with

obscure foveae, granules and lateral wrinkles. Mesosternum, metasternum and abdominal sternites as in *M. elongatus* except that the microsculpture is stronger, and the punctures rather coarser. All these sternites except mesosternum lack granules, which are absent also on epipleura.

Legs. As in *M. elongatus* except that sculpture is coarser, front tibiae granulate on lateral and ventral surfaces.

Aedeagus. Relatively small. In dorsal view basale only slighly expanded (in contast with all forms of *M. elongatus*) sides of apicale only slightly sinuate. In lateral view basale fairly strongly curved downwards at base; apicale slender, very slighly curved downwards from apex to base, with dorsal surface convex. The aedeagus is strikingly similar to that of *M. turbotti* although there are some rather subtle differences between them.

FEMALE

Like male only larger, broader and more convex.

DIMENSIONS

Range. Length 9.1-16.5 mm; width 4.7-8.3 mm.

GEOGRAPHICAL VARIATION

Although specimens of *M. pascoei* from all the Chatham Is are essentially the same (see Table 5), there is some size variation from island to island e.g. South East I specimens are slightly larger than others.

Table 5. Summary of characters of populations of *M. pascoei* (upper surface and aedeagus only), compared with *M. subcostatus*.

Character	*M. pascoei* (Chatham Is) typical form			*M. subcostatus* (Chatham Is) typical form
	Pitt I. Mangere I. S.E.I.	Forty Fours	Sisters	
Length (mm)	10.6-14.2	9.8-12.1	10.7-13.0	9.1-11.2
Width (mm)	5.6-7.9	5.4-6.6	5.8-7.6	4.7-6.2
Macropunctures	----------small & shallow----------			larger & deeper
Microsculpture	----------moderate----------			strong
Elytral costae	----------obsolete----------			well developed
Epipleural carina	weak	moderate	moderate	moderate
Elytral shape	oval	intermediate	intermediate	parallel sided
Basal elytral carina	absent	slight	obsolete	distinct
Elytral submarginal channels	concave	concave	almost flat	quite flat
Submarginal channels inner angle	----------obtuse----------			right angle
Apicale, dorsal	broadest	more slender	broader	most slender

TYPE MATERIAL. Holotype ♂ 13.4 x 7.0 mm BMNH.

TYPE LOCALITY. Pitt I, Chathams.

Material examined. Chatham Is. Pitt I., Mangere I, South East I, The Sisters, Forty Fours.

Distribution. Chatham Is, ca. 800 km east of Christchurch.

Mimopeus opaculus (Bates, 1873) (Figs. 8,23,56,58-64,70,71,75-81,83,86,87-91)

opaculus Bates 1873, Ann. Mag. Nat. Hist. (4)12:474-5 (*Cilibe*); Broun, 1880, Man. N.Z. Col. 1:368-9 (*Cilibe*); Hudson, 1934, N.Z. Beetles:88 *(Cilibe)*; Watt, 1968 N.Z. Ent. 4(1):39 (*Mimopeus*).
grandis Bates, 1873, Ann. Mag. Nat. Hist. (4)12:477 (*Cilibe*); Broun, 1880, Man N.Z. Col. 1:371.
major Sharp, 1903, Ent. Mon. Mag. 39:106 (*Cilibe*).
nitidulus Bates, 1873, Ann. Mag. Nat. Hist. (4)12:476 (*Cilibe*); Broun, 1880, Man. N.Z. Col. 1:370 (*Cilibe*).
otagensis Bates 1873, Ann. Mag. Nat. Hist. (4)12:476 (*Cilibe*); Broun, 1880, Man. N.Z. Col. 1:370 (*Cilibe*); Hudson, 1934, N.Z. Beetles 87-8.
smithianus Broun, 1909, Ann. Mag. Nat. Hist. (8)3:409-11 (*Cilibe*).
tarsalis Sharp, 1903, Eng. Mon. Mag. 39:107-8 (*Cilibe*).

MALE

Shape broadly oval or oblong-oval, showing considerable geographic variation, generally flattened. Colour usually black, dull on the dorsal surface, shining below, specimens freshly emerged from pupa reddish brown, legs shining black, antennae reddish black. Yellow hairs and pubescence present to variable degree on antennae, legs, mouthparts and under surface.

Dorsal surface. Labrum (Fig. 71) emarginate. Clypeus emarginate anteriorly, broad, slightly convex, clypeal sutures generally faint. Genae extending laterally just beyond eyes, parallel to eyes, or eyes more prominent than genae. Punctures of dorsal surface of head large, rarely separated by more than their own diameter, generally fairly deep and steep-sided, interspersed with small punctures.

Pronotum shows considerable geographic variation in shape (Figs. 75-78,88-91). Punctation similar to head, but punctures relatively larger, moderately steep-sided, interspersed with small punctures. Lateral prebasal depressions generally present, discal and median basal depressions sometimes present.

Scutellum transverse, triangular or pentagonal, shape variable, punctures small, generally deep, median part generally almost impunctate.

Elytra geographically variable in shape, broadly to relatively narrowly oval, depressed to relatively convex. Punctation like that of pronotum, interstices smooth or uneven, granules nearly always present on interstices of marginal channels, rarely on disc (Cuvier I and Stewart I populations). Submarginal channels always present, generally broad and shallow, epipleural carina barely to considerably upturned outside submarginal channels.

Ventral surface. Mentum finely punctured, transverse, with fine yellow setae. Pregular region of postgenae with moderately large punctures, interstices flat; gular region of postgenae deeply punctured, interstices uneven. Gula impunctate, shining, with irregular longitudinal wrinkles. Prosternum with shallow punctures, surface rather uneven in the middle, with some transverse

wrinkles. Intercoxal process bulbous posteriorly, with numerous very small punctures; submarginal grooves fairly broad and shallow. Proepisternum sparsely punctate, with very shallow punctures; interstices uneven, and bearing some small granules. Mesosternal intercoxal process (Fig. 86) relatively broad, finely punctate, almost quadrate posteriorly; submarginal grooves narrow and deeply impressed, marginal ridge narrow, depressed relative to central portion, slightly widened posteriorly. Mesepimeron smooth, shining, finely punctate. Metasternum short, finely and sparsely punctate. Epipleura of elytra with some transverse wrinkles; interstices smooth, with a very few fine punctures. Abdominal sternites moderately punctate, with fine macropunctures and very fine micropunctures. Interstices with faint microsculpture, much stronger on anal sternite. Submarginal grooves of all visible sternites except first distinctly impressed.

Aedeagus. As illustrated in Figs. 79-81 showing a little geographic variation; fairly stout.

FEMALE

Like male, but relatively slightly broader, legs slightly shorter and more slender.

DIMENSIONS

Range. Length 13.1-26.8 mm; width 7.2-11.8 mm.

GEOGRAPHICAL VARIATION

The type series (labelled only New Zealand) resembles specimens from the Waimakiriri valley. Geographical variation in the pronotum has been discussed above. It occurs also in size and proportions of the body as a whole, specimens from South Canterbury and the MacKenzie Basin frequently averaging smaller than in mid-Canterbury populations, and tending to be more elongate and convex. There is random or minor geographical variation in dorsal and ventral punctation, microsculpture, form of the aedeagus, and mesosternal intercoxal process. Study of Table 6 will show that the regional population classification is based partly on the form of the pronotum exhibited by various populations. This structure was selected for detailed study. In addition to the photographs of whole insects (Figs. 56-64), pronota are illustrated by outlines in Figs. 75-78, and 88-91. Study of these figures indicates the condiderable geographical variation occuring in the form of the pronotum in *M. opaculus.*

Table 7 lists the ratio greatest width of pronotum/middle length of pronotum (Pr.W./Pr.L) of a series of populations very roughly along a line from southwest to northeast. Males only were measured, in order to avoid introducing complications due to geographically variable sexual dimorphism. The populations chosen lie mainly within the chief area of distribution of the species, along the main line of clinal variation, but a few others have been included for comparative purposes. Marked changes of means within fairly short distances will be noted between Wandle Downs and lowland Kaikoura and between Red Rocks and Silverstream. Populations of *M. opaculus* on Banks Peninsula are distinguishable from lowland Canterbury populations by their more elongate form.

Specimens from islands in Cook Strait closely resemble those from the vicinity of Levin. Variation in Southern populations appears to be random rather than uniformally clinal. Specimens from Owaka in Southland are closer to specimens from Stewart Is than are other specimens from Otago and Southland. Specimens from Gore are less like Stewart Is specimens than are coastal specimens.

Specimens from Red Rocks and nearby localities on the coast south of Wellington are distinctly more convex than any other North Island specimens. Lyall Bay specimens are intermediate. In general appearance the Red Rocks specimens bear a striking resemblance to Banks Peninsula specimens but may be distinguished from the latter by the narrow mesosternal

intercoxal process. It may be noted that whereas the typical habitat is under rotten logs or stones in forest, at Red Rocks they are found under stones amongst coastal plants such as *Muhlenbeckia complexa, Coprosma acerosa* etc.

Specimens from the Marlborough Sounds islands more closely resemble the Red Rocks specimens than any other North Island specimens, except in pronotal ratio (Tables 6 & 7).

Specimens from the Western part of the Volcanic Plateau and north are characterised by the presence of granules (visible at 25 x magnification) in the elytral sub-marginal channels, and often on the hind and lateral slopes. Size appears to decrease northwards, and the pronotum becomes more elongate, while there is random variation in some other characters. All specimens examined from the Hawkes Bay and Gisborne districts are characterised by the presence of small granules on the elytral disc.

Details of other geographical variations can be found in Watt (1961).

Table 6. A comparison of the populations of *M. opaculus*, indicating geographical variation in some characters.

Character	Populations							
	Stewart Is.	Southland & Otago	Banks Pen.	*opaculus* (general)	Central N. Is.	Cook Strait	"Waiheke"	Cuvier Is.
Length (mm) minimum	13.6	13.1	15.0	14.1	14.0	18.5	13.8	16.6
maximum	16.3	17.9	19.7	17.6	18.5	22.8	16.3	19.2
Width (mm) minimum	8.0	7.2	7.8	7.3	7.2	10.1	6.8	8.9
maximum	9.1	9.8	10.2	10.2	11.2	12.8	8.3	10.0
Pronotum of "opaculus" type				M				
Usually elongate & convex			X		F		X	X
Mesosternal intercoxal process narrow				S	M	X	X	X
Granules present dorsally	X	X	X	X	S		X	X
Granules on elytral disc	X				F			X
Granules on pronotum	F				F			X
Granules on prosternum	X	S	X	F	X	X	X	X
Granules on proepisternum					S		X	X
Granules on epipleura	X	X	X	M	X	S	X	X
Granules on postgenae			S		F		X	
Dorsal microsculpture clearly visible at 25 x magnification								X

Key: X — all populations exhibit character (100%)
M — most populations exhibit character (over 70%)
S — some populations exhibit character (30-70%)
F — few populations exhibit character (less than 30%).

Table 7: Shows geographical variation in the ratio Pr.W./Pr.L. of male individuals of some populations of *Mimopeus opaculus*. (For further explanation see text).

Symbol	Locality	Mean ratio	Range	N*	Distance from previous locality km
S	Owen I Stewart Island	1.77	1.74-1.79	5	—
O	Owaka, Southland	1.67	1.63-1.70	2	177
TI	Taieri Island, Otago	1.61	1.58-1.63	4	64
D	Dunedin	1.64	1.61-1.67	4	24
H	Hampden, Otago	1.69	1.67-1.71	2	64
	(Makikihi, south Canterbury)	1.69		1	72
A	Albury, south Canterbury	1.67	1.65-1.71	4	48
W	Waterton, Canterbury	1.77	1.74-1.79	2	72
L	Lake Coleridge, Canterbury	1.75	1.71-1.81	4	80
C	Cass, Canterbury	1.78	1.74-1.81	4	40
WD	Wandle Downs, Waiau, north Canterbury	1.74	1.69-1.77	5	112
SK	Snowflake Hut, Seaward Kaikoura Range	1.76	1.70-1.82	5	56
CF	Charwell Forks, south Marlborough	1.68	1.63-1.73	3	32†
K	Kaikoura, south Marlborough	1.62	1.61-1..63	3	24
BI	Brothers Islands, Cook Strait	1.65	1.62-1.68	5	144
R	Red Rocks, Wellington	1.58	1.55-1.64	10	40
V	Silverstream, Wellington	1.65	1.62-1.67	4	32
F	Featherston, Wairarapa Valley	1.65	1.62-1.67	2	24
MT	Masterton, Wairarapa Valley	1.68	1.65-1.70	2	32
P	Pahiatua, Wairarapa Valley	1.70	1.69-1.72	3	56
T	Tongoio, Hawkes Bay	1.67	1.64-1.69	3	161
G	Waihirere, Gisborne	1.60	1.57-1.61	4	128
AK	Banks Pen., Canterbury	1.62	1.53-1.68	10	—
SI	Stephens Island Cook Strait	1.69	1.68-1.70	5	—

* Number of specimens measured.
† Distance from Wandle Downs.

TYPE MATERIAL. Lectotype of *opaculus* Bates ♂ 17.8 x 9.5 mm BMNH.
Holotype of *grandis* Bates ♂ 19.1 x 8.7 mm BMNH.
Lectotype of *major* Sharp ♀ 24.2 x 12.3 mm BMNH.
Holotype of *nitidulus* Bates ♀ 15.8 x 7.8 mm BMNH.
Lectotype of *otagensis* Bates ♂ 15.5 x 7.3 mm BMNH.
Lectotype of *smithianus* Broun ♂ 17.6 x 8.8 mm NZAC.
Holotype of *tarsalis* Sharp ♂ 19.5 x 9.8 mm BMNH.

TYPE LOCALITY. New Zealand.

Material examined. Cuvier I, "Waiheke", Hamilton, Otorohanga, Toa Bridge Waipa Riv, Kihikihi, Taumarunui.

New Plymouth, Opunake, Waihirere, Waingahe, Hangaroa, Tiniroto, Tangoio, Waipotahi Beach Napier, Rissington Hastings, Norsewood, Lake Waikaremoana.

Ohakune, Taihape, Karioi, Mangaweka, Upper Rangitikei River, Wanganui, Totara Reserve Rangitikei Valley Pohangina, Feilding, Levin (Waiopehu Rd Reserve), Kairanga Palmerston North, Woodville Domain, Pahiatua, Pori, Mikimiki Bush Tararuas, Masterton, Greytown, Featherston, Mt Holdsworth, Rimutaka Ranges, Akatarawa West, Te Marua, Hutt Valley, Silverstream, Melling, Wainui Hills, Petone Lowry Bay, Titahi Bay, Khandallah, Kelburn, Northland, Wellington, Botanical Gardens Wellington, Somes Is, Lyall Bay, Red Rocks, Sinclair Head, Ohiro Bay, Makara.

Stephens I, Trio I, Jag Rocks, Sentinel Rock (off Pelorus Sound).

Brothers Is, The Twins, Queen Charlotte Sound, Motungarara Is, Black Rock, Hapuka River Kaikoura, Charwell Forks, Seaward Kaikoura Ra.

Wandle Downs Waiau, Cass, Lake Coleridge, Waterton, Banks Pen., Albury.

Cormacks, Oamaru, Hampden, Poolburn, Rock and Pillar Range, Waikouaitu, Botanical Gardens Dunedin, Blue fish Bay, Opoho, Mt Cargill, Portobello, Otago Peninsula Limekilns, Waipori, Waihemo, Taieri Islands, Taieri Mouth, Mt Maungatua.

Owaka, Gore, Mossburn, L. Manapouri, Te Anau Picnic Point, Owen I Stewart I.

Distribution and Ecology. Cuvier Island, S. Auckland, Taranaki, Gisborne, Hawkes Bay, Wellington, Cook Strait Is, Marlborough, Canterbury, Otago, Southland, Stewart Island; abundant in some localities. Both adults and larvae are found under stones, under or in rotten logs, and amongst other dead vegetable matter. Adults are found on the bark of totara and similar trees at night. Typically the species is restricted to forest and forest remnants, but certain populations are found in tussock country (e.g. near Lake Tekapo).

The earlier view of the author (Watt 1961) was that *Cilibe opacula* included *C. major*, *C. smithiana* and the two new subspecies from Waiheke and Cuvier Islands respectively. These North Island and Cook Strait groups were formerly regarded by the writer as constituting two distinct species (Watt 1961). Specimens examined before June, 1962 were labelled *C. major, C. major smithiana* etc. The task of relabelling the multitude of specimens concerned being very great, it has not been undertaken. Specimens in NMNZ labelled Waiheke Is., appear to have been mislabelled. Many later searches have failed to confirm the presence of this species on Waiheke.

Over 800 specimens of *M. opaculus* have been examined. Critical comparison of northern populations of *M. opaculus* with Cook Strait populations has shown that the characters used to separate *opacula* and "*major*" previously are unreliable; and has failed to disclose any other characters that will enable specific separation. Although there is variation in the shape of the aedeagus, the general form is the same throughout

the species. There is considerable geographical variation in such characters as body shape, the presence and distribution of granules, the form of the mesosternal intercoxal process and the intensity of microsculpture (see Table 6), but substantial structural discontinuities that separate species are lacking.

Mimopeus buchanani (Broun, 1880) (Figs. 65,67 68)

buchanani Broun, 1880, Man. N.Z. Col. 1:377-8 (*Cilibe*); Hudson, 1934, N.Z. Beetles: 88 (*Cilibe*); Watt, 1968, N.Z. Ent. 4(1):39 (*Mimopeus*).
schauinslandi Sharp, 1903, Eng. Mon. Mag. 39:106 (*Cilibe*).

Most closely related to *M. lateralis*, similar in some respects to *opaculus* but readily distinguished being smaller and duller, and having a much more slender aedeagus. Intermediate in its broad, depressed form, between the *elongatus* and *opaculus* species groups.

MALE

Broad, dorsoventrally flattened, colour very dull reddish grey. Antennae relatively long, terminal segment elongate, microsculpture of last three segments very strong.

Dorsal Surface. Labrum slightly emarginate anteriorly, finely punctured, yellow setae relatively long. Upper surface of head moderately punctured, macropunctures separated by about their own diameter, fairly deep and steep-sided. Microsculpture of interstices strong, clearly visible at 25 x magnification. Pronotum (Fig. 65) broad and flattened, sides curved gradually from anterior to posterior angles, widest part usually just in front of posterior angles. Punctures deep and steep-sided, rarely separated by more than their own diameter. Interstices of disc flat, bearing strong microsculpture visible at 25 x magnification, interstices near lateral margin uneven, bearing small, smooth, rounded elevations which are insufficiently distinct to be classed as granules.

Elytra broad, depressed. Epipleural carina not reflexed outside submarginal channel. Costae very obscure. Macropunctures deep and steep-sided, rarely separated by more than their own diameter; each puncture except those of disc bears a short, backwardly-directed yellow seta just visible at 25 x magnification.

Ventral surface. Pregular region of postgenae deeply punctured, punctures of gular region finer and shallower, each bearing a fairly long yellow seta. Interstices uneven, but elevations smooth and rounded. Gula shining, with numerous transverse grooves and with a few small, deep punctures anteriorly.

Prosternum with fine deep punctures; submarginal grooves on intercoxal process narrow and shallow; granules present on lateral parts in front of coxae. Proepisternum bearing small, distinct, punctures, from each of which arises a fine yellow seta visible at 25 x magnification; interstices flat.

Mesosternal intercoxal process as in Fig. 68, finely and moderately deeply punctured. Metasternum and abdominal sternites with similar punctation. Epipleura of elytra with a few fine punctures and small granules and microsculpture, all visible at 25 x magnification.

Aedeagus (Fig. 67). Much more slender than that of any species of the *opaculus* group, approaching the type characteristic of the *humeralis* superspecies. In dorsal view basale with sides almost straight, converging slighly towards apex, apicale just wider than apex of basale, apices of parameres barely divergent. In lateral view, dorsal surface of apicale almost plane, not concave as in the *opaculus* group.

FEMALE

Like male, but legs, especially hind femora, slightly shorter and more slender; elytra slightly broader.

DIMENSIONS

Range. Length 10.0-18.2 mm; width 4.9-9.8 mm.

GEOGRAPHICAL VARIATION

The above description applies to specimens from the North Island mainland near Wellington. The species as a whole shows considerable geographical variation.

A comparison of the more distinct populations is given in Table 8. Wellington specimens have been taken as the standard, so that "basale of aedeagus slender" means that the basale is distinctly more slender in the populations indicated than in North Island mainland populations. The most distinct populations are those from Maud Island, Pelorus Sound, Gordon's Knob and Lake Rotoiti. Each island population differs in minor respects from its nearest relatives.

Table 8. Summary of characters of the more distinct populations of *Mimopeus buchanani*. (For further explanation see text).

Character	Populations							
	Wellington	Mana I.	Stephens I. Chetwode Is.	Trio I.	Maud I.	Kokomohua I. Motungarara I.	Picton	Gordon's Knob Rotoiti
Length (mm) minimum	10.5	11.1	12.1	13.0	14.0	12.2	11.3	9.9
maximum	14.1	13.6	15.3	16.0	15.7	14.5	14.0	12.4
Width (mm) minimum	5.6	6.2	6.2	7.2	7.8	6.8	5.8	4.9
maximum	7.1	7.8	8.5	8.9	9.4	8.2	7.5	6.5
Very Broad		X			X			
Narrow							X	X
Depressed		X					X	
Pronotal and elytral microsculpture very strong				X				
Small shining areas on pronotum			few	many	many		few	
% with widest part of pronotum at posterior angles (rough estimate)	25	100	30	20	80	20	100	30
Mesosternal intercoxal process narrow								X
Basale of aedeagus slender		X						
Apicale elongate				X		X		
Apicale short								X

In the absence of more material from the Nelson area and the mainland of the Marlborough Sounds, it is inappropriate to discuss the relationships of the various populations, except to state that they all appear to be conspecific. The Gordon's Knob specimens do not resemble the northern Canterbury species *M. lateralis* any more than do the other populations of *M. buchanani.*

Ignoring the unusually distinct populations, geographical variation in most characters appears to be clinal roughly along the line Wellington — Stephens I — Chetwode Is — Queen Charlotte Sound islands — Picton.

TYPE MATERIAL. Lectotype ♂ of *buchanani* Broun 13.3 x 6.2 mm BMNH. Selected from a series of two syntypes, designated and labelled as such: Wellington *Cilibe buchanani*, 677. T.B./BMNH 1922-182.

Paralectotype ♀ 12.1 x 6.8 mm. Lacking determination label, but otherwise bearing the same data. T.B./BMNH.

Lectotype ♀ of *schauinslandi* Sharp 16.1 x 7.7 mm BMNH. *Cilibe schauinslandi* Type D.S., Stephens Island, Schauinsland. D.S./BMNH 1905-313.

Paralectotype ♀ with same data as lectotype except determination label; lacks head and prothorax. D.S./BMNH.

TYPE LOCALITY. Welllington.

Material examined. Types as above; 174 other specimens.

Wiltons Bush, Porirua, Pukerua Bay, Paekakariki, Mana I, Kapiti I, Stephens I, Middle Trio I, Maud I, Outer Chetwode I, Kokomohua I, Motungarara I, Picton, Gordon's Knob, Rotoiti, Boulder Bank Nelson.

Distribution. North Island near Wellington, Cook Strait and Marlborough Sounds islands, Picton, eastern Nelson Province.

Mimopeus humeralis (Bates, 1873) (Figs. 35,47,53)

humeralis Bates, 1873, Ann. Mag. Nat. Hist (4)12:480-1 (*Cilibe*); Broun, 1880, Man. N.Z. Col. 1:373 (*Cilibe*); Hudson, 1934, N.Z. Beetles: 88 (*Cilibe*); Watt, 1968, N.Z. Ent. 4(1):39 (*Mimopeus*).

Most closely related to *M. thoracicus* also resembling *M. parallelus* in many respects. Distinguished from *M. parallelus* by its more elongate, slender aedeagus (Figs. 35,53), strikingly different elytral sculpture, and other characters; and from *M. thoracicus* by the aedeagus and more elongate form. Distinguished from *M. vallis* and *M. parvus* by its more elongate, slender aedeagus, more prominent elytral shoulders, broader elytral submarginal channels, and raised, more distinct, basal elytral carinae. Compared previously with the sympatric and superficially similar *M. neglectus.*

MALE

Oblong-oval, parallel-sided, convex. Upper surface dull black, antennae reddish, femora and tarsi reddish black underside shining black.

Dorsal surface. Terminal antennal segment slightly longer than broad. Labrum emarginate anteriorly, finely punctate, yellow setae relatively long and stout. Clypeus strongly emarginate anteriorly, clypeal suture very faint. Genae projecting slightly further laterally than eyes. Punctures of upper surface of head small, most separated by at least their own diameter, micropunctures of interstices very small and shallow, microsculpture strong, visible at 25 x magnification.

Pronotum (Fig. 47) rather less transverse than in most species of *Mimopeus*; anterior and posterior angles sharp, but not very prominent; curvature of sides varies individually, but never very strong; marginal thickening indistinct; base slightly bisinuate. Submarginal channels obsolete. Punctures small, separated by more than twice their own diameter on disc, and by more than their own diameter elsewhere. Microsculpture of interstices strong, visible at 25 x magnification, micropunctures very small and shallow.

Scutellum transverse, triangular, smooth, shining, finely and deeply punctate.

Elytra convex, sides sub-parallel. Shoulder very prominent, narrowly rounded (Fig. 47); epipleural carina distinct, slightly thickened to about mid-length, submarginal channel concave within it, particularly inside humeral angle. Slightly raised, indistinct longitudinal elevations are present, most distinct at base. Basal margin marked by a distinct, raised carina, extending from shoulder two thirds the distance to scutellum. Punctures small, not steep-sided, generally separated by at least twice their own diameter, interstices slightly convex, fairly even, sometimes with irregular transverse wrinkles, microsculpture just visible at 25 x magnification. Posterior part of lateral slope and upper part of hind slope bearing granules visible at 25 x magnification.

Ventral surface. Sides and posterior angles of mentum rounded in a fairly broad curve. Pregular region of postgenae deeply punctate, interstices uneven, gular region very finely punctate, without granules; gula smooth, with irregular transverse depressions.

Punctures of prosternum fine, sparse and shallow, surface even, with some small granules laterally. Punctation of proepisternum similar, each puncture bearing a fine, short seta; microsculpture strong, visible at 25 x magnification.

Mesosternal intercoxal process relatively narrow finely punctate, submarginal grooves shallow, marginal ridges narrow. Metasternum and metepisternum finely puctate, without granules.

Abdominal sternites with relatively large shallow punctures, micropunctures of interstices clearly visible at 25 x magnification. Distinct submarginal grooves present on all except first visible sternite. Epipleura with very small punctures, some small granules, and microsculpture visible at 25 x magnification.

Legs. Tibiae fairly closely and deeply punctate, interstices of middle pair uneven.

Aedeagus (Fig. 35). In dorsal view apicale elongate and very slender; basale slender, tapering from just distal to base of apex. Slender in lateral view, apicale straight, basale moderately curved.

FEMALE

Like male, but legs shorter and more slender.

DIMENSIONS

Range. Length 9.6-13.6 mm; width 4.8-6.3 mm.

GEOGRAPHICAL VARIATION

The description is based on the types and specimens from the coast south of Wellington. Specimens from east of Wellington Harbour have granules visible at 25 x magnification on the elytral disc, and there is slight variation in sculpture and in the form of the aedeagus.

TYPE MATERIAL. Lectotype ♂ 10.3 x 5.2 mm BMNH. Selected from a series of three syntypes, designated and labelled as such: New Zealand, *Cilibe humeralis* Type F. Bates, ♂? F.B./B.M. 81-19.

Paralectotypes (2 ♀) with same data as lectotype, F.B./B.M.

TYPE LOCALITY. "New Zealand", here restricted to Wellington, as the types closely resemble specimens from there, particularly from the coast south of Wellington City.

Material examined. Lectotype ♂, 2 paralectotypes; 89 other specimens.

Red Rocks, Sinclair Head, Terawhiti Beach, Mahanga Bay, Wellington Heights, Strathmore, Moa Point, Breaker Bay, Somes I, Ward I, Orongorongo, Pencarrow, Palliser Bay.

Distribution and Ecology. Wellington south coast and vicinity of Wellington Harbour, Wairarapa south coast. Found under stones, or under *Muhlenbeckia* and similar coastal plants. I have collected it sympatrically with *M. elongatus* and *M. opaculus* at Red Rocks but it is not as common as the other two species. Unlike *M. neglectus* it does not occur under *Pimelia* and similar plants growing on fine shingle, but seems to prefer more stable soil conditions.

Mimopeus thoracicus (Bates, 1873) (Figs. 38,50)

thoracicus Bates, 1873, Ann. Mag. Nat. Hist. (4) 12:481 (*Cilibe*); Broun, 1880, Man. N.Z. Col. 1:373-4 (*Cilibe*); Watt, 1968, N.Z. Ent. 4(1):39 (*Mimopeus*).
brevipennis Bates, 1873 Ann. Mag. Nat. Hist. (4) 12:482 (*Cilibe*); Broun, 1880, Man. N.Z. Col. 1:374 (*Cilibe*).

Most closely related to *M. humeralis* and *M. vallis* more distantly related to *M. parallelus* and *M. parvus*. Distinguished from *M. vallis* and *M. parvus* by its smaller more slender aedeagus, more prominent and narrowly rounded elytral shoulders, broader elytral submarginal channels, and raised, more distinct basal elytral carinae. Distinguished from *M. parallelus* by its much smaller and shallower elytral punctures, different elytral sculpture, and other characters. Compared with *M. humeralis*, easily distinguished by its less elongate aedeagus, and broader, less elongate form.

MALE

Broad, relatively parallel-sided. Upper surface reddish black, antennae and legs reddish, undersurface shining reddish brown.

Dorsal surface. Antenna with terminal segment transverse. Labrum and head as in *M. humeralis* except that anterior margin of clypeus less strongly emarginate, and punctures larger and deeper, particularly on front. Pronotum usually broader than in *M. humeralis* (Fig.

50), rather variable, anterior and posterior angles less prominent and blunter, marginal thickening more distinct, indistinct submarginal channels present. Punctures relatively larger, mostly not separated by more than their own diameter except on disc.

Elytra relatively shorter and broader than in *M. humeralis*, humeral angle (shoulder) prominent or very prominent, often with a sinuation of the side behind it, submarginal channel less concave than in *M. humeralis*. Punctation as in *M. humeralis*, but granules indistinct, not always visible at 25 x magnification.

Ventral surface. Sides and base of mentum straighter than in *M. humeralis*. Punctures of pregular region of postgenae smaller and shallower, those of gular region deeper, with rather distinct granules present on interstices. Entire surface of prosternum except intercoxal process bearing numerous distinct granules, punctures deeper than in *M. humeralis*. Proepisternum finely punctate, longitudinally rugose, bearing small granules visible at 25 x magnification. Posterior part of intercoxal process less prominent than in *M. humeralis*.

Mesosternal intercoxal process broader. Metasternum and metepisternum more deeply punctate and punctures larger than in *M. humeralis*. Punctures of abdominal sternites larger and deeper, surface shining, microsculpture not as strong as in *M. humeralis*. Epipleura, lateral parts of metasternum and abdominal sternites bearing distinct granules visible at 25 x magnification.

Aedeagus (Fig. 38). Less elongate and stouter in dorsal view than in *M. humeralis*, basale considerably stouter. Slender in lateral view.

FEMALE

Like male, but usually relatively broader, with legs slightly shorter and more slender.

DIMENSIONS

Range. Length 8.2-12.0 mm; width 4.5-5.9 mm.

GEOGRAPHICAL VARIATION

The description applies to specimens from the vicinity of Christchurch, excluding Banks Peninsula. Specimens from localities on Banks Peninsula have larger and deeper punctures, and usually average larger.

There is a substantial gap between Amberley and Oaro from which no specimens have been available for study, but it appears that the following trends in geographical variation northwards from Christchurch occur:

1. Increase in strength of elytral sculpture.
2. Increase in strength of dorsal microsculpture.
3. Decrease in size of prosternal granules.
4. Decrease in size of proepisternal granules, until they almost disappear in Kaikoura specimens.
5. Broadening of the aedeagus.

Trends 3, 4 and 5 appear to be reversed north of Kaikoura, in specimens from Cape Campbell.

The type of *M. thoracicus* is apparently an extreme variant, the prothorax being more elongate than in most representatives of the species. The majority of specimens more closely resemble the types of *M. brevipennis* in the form of the pronotum but there is so much individual variation in this character in the species that it is obviously of no specific value. Thus *M. brevipennis* is synonymised with *M. thoracicus*.

TYPE MATERIAL. Holotype ♀ (unique type) 11.4 x 5.6 mm BMNH. *M. thoracicus* type F. Bates. F.B./B.M. 81-19.

Lectotype ♀ of *brevipennis* Bates 12.1 x 6.1 mm BMNH. New Zealand, *Cilibe brevipennis* type F. Bates. F.B./B.M. 81-19.

Paralectotypes (2 ♀) with same data as lectotype, F.B./B.M.

TYPE LOCALITY. "New Zealand". A few variants similar to the holotype in pronotal form are present amongst the material from just north of Christchurch, particularly a specimen from Kaiapoi. Thus the type locality is restricted to the vicinity of Christchurch.

Material examined. Types (as above); 143 other specimens.

Cape Campbell, Paparoa Point, South Bay, Kaikoura, Oaro south of Kaikoura. Amberley Beach, Mt Grey, Kaiapoi, Christchurch, Spreydon, Sumner, Lyttelton, Port Levy, S.W. of Albury, Temuka, Queenstown, Dunedin.

Distribution and Ecology. Marlborough, Canterbury, Otago. In Marlborough *M. thoracicus* appears to be exclusively coastal, but there are two records from inland Canterbury (Mt Grey and Albury), and one (Queenstown) from inland Otago. It seems unlikely that all these records are erroneous, but on the other hand it is surprising that the species has not been collected well inland more frequently if it really occurs as far from the seas as Queenstown.

In coastal Marlborough adults and larvae are found under stones, tussocks and other plants, amongst vegetable debris on which they probably feed. They have been found under *Pinus* logs at Kaikoura and in sandy soil at Sumner. The one thing that all these habitats appear to have in common is a well-drained substrate. Thus there is no apparent compelling ecological reason why they should not be able to exist away from the coast.

M. thoracicus appears to replace *M. elongatus* both ecologically and geographically, on the east coast of the South Island from Cape Campbell to Temuka.

Mimopeus lateralis (Broun, 1909) (Figs. 52,66,69)

lateralis Broun, 1909, Ann. Mag. Nat. Hist. (8) 3: 408 (*Cilibe*); Watt, 1968, N.Z. Ent. 4(1):39 (*Mimopeus*).

Closely related to *M. buchanani*. Structurally the two taxa are quite distinct and easily recognised.

MALE

Upper surface dull black, under surface shining black, legs and antennae dark reddish black. Form approximately as in North Island and Stephens Island populations of *M. buchanani*, i.e. broadly oval and fairly flat.

Dorsal surface. Antennae as in *M. buchanani* but darker in colour, with proximal segments relatively shorter. Head as in *M. buchanani* but punctures deeper, microsculpture much stronger (just visible at 10 x magnification) granules present between eyes and on vertex. Pronotum bearing very strong microsculpture, visible at 10 x magnification, and numerous shining granules over the entire surface, but larger on the submarginal channels than on the disc. Each pronotal macropuncture bears a small, stout, short hair which does not reach usually beyond the edge of the pit, and is just visible at 25 x magnification. Scutellum triangular, deeply punctured, surface uneven, almost granulate.

Punctation, sculpture and microsculpture of elytra like that of pronotum except granules, which are larger, and interstices, which are more uneven. Costae visible but barely convex and not at all prominent. Shoulder broadly rounded, epipleural carina slightly reflexed, submarginal channel flat, extending almost to apex, inner angle distinct (obsolete in *M. buchanani*).

Ventral surface. Punctures of mentum, cardo, stipes and postgenae much larger and deeper than in *M. buchanani*; interstices uneven. Granules present over entire surface of prosternum (excluding intercoxal process) and proepisternum: much larger than in *M. buchanani* (in which they are usually absent or obsolete on proepisternum), punctures larger and deeper, especially on prosternal intercoxal process. Punctures of other sternites and episternites much larger and deeper than in *M. buchanani.* Epipleura densely granulate at base, granules becoming obsolete towards apex.

Femora as in *M. buchanani* but black, tibiae bearing larger and deeper punctures and more irregular interstices.

Aedeagus (Fig. 69). Less elongate than that of *M. buchanani.* Relatively stouter and more strongly curved in lateral view.

FEMALE

Like male, but usually slightly larger and more convex, legs relatively shorter.

DIMENSIONS

Range. Length 11.1-16.6 mm; width 6.1 - 7.8 mm.

GEOGRAPHICAL VARIATION

Not studied in detail. There appears to be random variation in size, development of granules (present in some places but not as strongly developed) and in the structure of the aedeagus, which is larger and stouter in specimens from the Upper Waiau Valley (N.W. of the type locality, Hanmer).

TYPE MATERIAL. Lectotype ♀ BMNH selected from a series of 3 syntypes, designated and labelled as such: Hanmer, Lewis, 2843, *Cilibe lateralis.* T.B./B.M. 1922-182.

Paralectotypes (2 ♀). There are 2 specimens in the Broun Collection, NZAC, which bear the label "*Cilibe lateralis*" in Broun's script, but lack locality data. As these specimens are very similar to the lectotype, and appear to be examples of the same population they are regarded as syntypes. Broun (1909) mentions "Three examples from Mr J.H. Lewis" in his description. A fourth specimen in the Broun Collection, BMNH labelled "Canterbury, *Cilibe lateralis*" differs from the specimens discussed above in some respects, and as Broun mentions only 3 specimens, cannot be regarded as a syntype. Another specimen labelled "Dyer's Pass, 23-9-1914, var. 2843" is an example of *M. granulosus* Brême.

TYPE LOCALITY. Hamner, Northern Canterbury.

Material examined. Lectotype ♀, paralectotypes (2 ♀), 51 other specimens.

Canterbury, Hanmer, Horseshoe Lake, Waiau River, Manuka Stream Waiau River, Upper Clarence Valley, Mt Percival, Snowflake Ridge, Kaikoura, Hurunui Gorge, Balmoral, Tarndale, Eyrewell S.F., Albury.

Distribution and Ecology. Apparently most common in North Canterbury and Southern Marlborough with but one record from South Canterbury. Found near Hanmer under stones in dry scrub or tussock country, and occurring elsewhere in exotic pine forests.

Mimopeus granulosus (Brême, 1842) (Figs. 54,94,102)

granulosus Brême, 1842, Mon. des Cossyphides p.39, pl 7, fig. 5 (*Cilibe*); Blanchard, 1853, Voy. Pol. Sud 4: 149 (*Cilibe*); Lacordaire, 1859, Gen. Col. 5: 350 (*Cilibe*); F. Bates, 1873, Ann. Mag. Nat. Hist. (4) 12: 482 (*Cilibe*); Broun, 1880, Man. N.Z. Col. 1: 375 (*Cilibe*); Watt, 1968, N.Z. Ent. 4(1): 39 (*Mimopeus*).

MALE

Elongate oval, rather parallel-sided, convex. Colour dull dark reddish brown; underside shining reddish black.

Dorsal surface. Labrum barely emarginate, finely punctate. Anterior edge of clypeus slightly emarginate; clypeal sutures faint. Eyes extending slightly further laterally than genal canthus, or parallel with it. Clypeus closely punctate, punctures separated by slightly more than their own diameter, interspersed with small micropunctures. Punctures of front and vertex larger, separated by less than their own diameter, punctures between eyes particularly deep and close-set; interstices uneven; micropunctures also rather larger than on clypeus. Each macropuncture bears a fine yellow seta visible at 100 x magnification. Interstices shining, covered with microsculpture visible at 100 x magnification, but not at 25 x.

Pronotum convex, transverse, about 1.6 x broader than long, individually variable. Anterior angles sharp, acute. Sides moderately curved, sometimes subparallel behind middle, but always converging at least slightly to posterior angles. Latter rectangular or acute; base moderately bisinuate. Submarginal channels obsolete. Marginal thickening extends from posterior angles around anterior angles almost to midline. Pronotum densely punctured, punctures large, broadly oval, deep, rather steep-sided, elongated longitudinally. Punctation particularly dense towards margins, especially in submarginal channels. Micropunctures rather deep; microsculpture stronger than on head, just visible at 25 x magnification. Each macropuncture bears a recumbent yellow seta usually extending just beyond the margin of the puncture; these are just visible at 25 x magnification on clean specimens.

Scutellum transverse; punctures about half diameter of macropunctures of pronotum and elytra, separated by considerably less than their own diameter; interstices uneven and shining.

Elytra convex, oblong-oval, shoulders square, sides sub-parallel, widest a little behind mid-length. Submarginal channels almost flat near base, inner angle distinct, almost at right angle to about mid-length. Epipleural carina thickened but not reflexed. Costae distinct. Diameter of macropunctures about two thirds diameter of pronotal macropunctures, but micropunctures larger and deeper than those of pronotum. Interstices very uneven, bearing large prominent smooth granules, especially on lateral slopes. Each macropuncture bears a fine seta, but these are difficult to see except in very clean specimens.

Ventral surface. Mentum transverse, about 2 x broader than long, finely punctured, each puncture bearing a moderately long yellow seta. Pregular region of postgenae with deep round punctures, separated by about their own diameter, interstices uneven. Gular region with laterally elongate, shallower punctures, interstices rounded and shining. Gula smooth shining, with a few small shallow punctures laterally and shallow transverse grooves anteriorly. Laterally, punctures of the postgenae bear fine yellow setae, clearly visible at 25 x magnification.

Prosternal intercoxal process relatively broad and quite flat, submarginal grooves broad and shallow, posterior projection weak. Interstices of anterior part of prosternum bearing small granules, punctation like that of postgenae. Proepisternum distinctly but distantly punctured, interstices smooth, bearing some small granules.

Mesosternum finely but deeply punctured, each puncture bearing a seta which is relatively long except on the intercoxal process, where the setae are short. Intercoxal process narrow, median part convex, submarginal grooves deep and narrow. Mesepisternum finely and distantly punctured, mesepimeron closely punctured.

Metasternum and metepisternum shining, with distinct but fairly shallow punctures, separated by about 2 x their own diameter, each bearing a yellow seta.

Abdominal sternites finely and distantly punctured medially, punctures larger laterally. Each puncture bears a recumbent seta, short near middle, longer at the sides. Distinct submarginal grooves present on all visible sternites except the first. Granules present on epipleura.

Legs. Femora finely punctured. Tibiae deeply punctured, interstices uneven, especially on front tibia. Setae present on dorsal and anterior surfaces of tibiae, very fine on ventral surface. On posterior surface of front tibiae, and anterior and posterior surfaces of mid- and hind-tibiae, are small, apically directed spines visible at 25 x magnification. Outer angle of anterior tibia not very prominent, no sinus present between it and spur (Fig. 102).

Aedeagus (Fig. 94). Slender in dorsal view. Apicale very narrowly rounded apically, sides almost straight, wider at base than apex of basale, basally broadening gradually almost to base. Apicale very slender in lateral view. Basale slender, slightly curved downwards.

FEMALE

Like male, but legs slightly shorter and more slender.

DIMENSIONS

Range. Length 10.1-12.2 mm; width 5.2-6.5 mm.

GEOGRAPHICAL VARIATION

Not separable from individual variation, which occurs in shape, size and sculpture, but is fairly slight.

TYPE MATERIAL. Lectotype ♀ 11.5 x 5.1 mm Torino.

TYPE LOCALITY. "New Zealand". In 1840, the ships *Astrolabe* and *Zelée* under Dumont d'Urville visited only Hoopers Inlet on Otago Pen., Akaroa on Banks Pen. and the Bay of Islands (Dunmore 1969). As *M. granulosus* is confined to Banks Peninsula, the type locality is restricted to Akaroa.

Material examined. 55 specimens.

Akaroa, Mt Evans Purau, Birdlings Flat, Motukarara, Gebbies Pass, Governors Bay, Kennedy's Bush Gully, Puke Atua Bush Port Hills, Lyttelton, Dyers Pass.

Distribution and Ecology. Apparently confined to Banks Peninsula. It is found under stones or logs, usually in remnants of native forest or in shelter belts of exotic trees. I have not collected it in open grassland, and there is no indication in the records that it occurs there.

The slender aedeagus of this species recalls that of the *humeralis* superspecies, as does also the convex subparallel-sided form. The punctation, however, is quite distinct from that of any of the *humeralis* group, being much coarser and deeper. The aedeagus is not at all like the relatively stout structure of *M. costellus*, but there are so many close similarities between the two species that these can hardly have all arisen by convergence. Thus it appears that *M. granulosus* is most closely related to *M. costellus*, and shows affinities also with the *humeralis* superspecies.

Mimopeus subcostatus (Sharp, 1903) (Figs. 37,43,45)

subcostatus Sharp, 1903, Ent. Mon. Mag. 39:107 (*Cilibe*); Broun, 1909, Trans N.Z. Inst. 41:149 (*Cilibe*); Watt, 1968, N.Z. Ent. 4(1):39 (*Mimopeus*).
saragoides Broun, 1909, Trans. N.Z. Inst. 41:148 (*Cilibe*).

Smaller than most individuals of *M. pascoei*. Form more parallel-sided, disc of pronotum and elytra less convex. Head more deeply punctured, punctures of pronotum and elytra deeper and larger, the sides steeper. Elytra subcostate, the costae becoming more distinct laterally where they are separated by rows of coarse, sometimes confluent punctures and foveae. Submarginal channels broader and flatter, inner angle making a right angle with the outer costa (Fig. 45), epipleural carina more distinct. A distinct carina is present at the base of the elytra (Fig. 43), running from the shoulder one third of the distance to the scutellum, but is barely raised. Small granules, just visible at 25 x magnification, present on elytral interstices.

Sculpture of postgenae and thoracic sterna stronger than in *M. pascoei*, undersurface otherwise similar.

Aedeagus (Fig. 37). More slender in dorsal view, basale more strongly curved in lateral view.

DIMENSIONS

Range. Length 9.1-11.2 mm; width 4.7-6.2 mm.

GEOGRAPHICAL VARIATION

Not studied, due to inadequate material but probably slight (see Table 5).

TYPE MATERIAL. Holotype ♂ (unique type) 12.5 x 6.0 mm BMNH. *M. subcostatus* type D.S., Chatham Island, Schauinsland. D.S./B.M. 1905-313.

Holotype prob. ♀ of *M. saragoides* 11.6 x 5.7 mm BMNH. Chatham Islands, Broun coll., B.M. 1922-482, *saragoides*, Pitt Island, *M. saragoides*.

TYPE LOCALITY. Chatham Is. ca. 800 km east of Christchurch.

Material examined. Holotype ♂, holotype prob. ♀ of *M. saragoides* (abdomen missing), 25 other specimens.

Chatham I, Wharekauri, Kaingaroa.

Distribution. Chatham Islands, probably coastal.

M. subcostatus would trace to *M. pascoei* in the key in Part 1. It can be distinguished from that species in the following respects. Microsculpture of pronotum and elytra strong; micropunctures relatively large, deep and steep-sided; elytra parallel sided, with submarginal channel broad and flat, and inner angle distinct; basal carina of elytra distinct laterally.

Mimopeus costellus (Broun, 1905) (Figs. 20, 51, 92, 93)

costellus Broun, 1905, Ann. Mag. Nat. Hist. (7)15:544-5 (*Cilibe*); Watt, 1968, N.Z. Ent. 4(1):39 (*Mimopeus*).

Most closely related to *M. granulosus*, but differing especially in the structure of the aedeagus. Readily distinguished from *M. granulosus* by the stouter aedeagus, straighter, more regular and usually more distinct elytral costae and usually larger size. The superficial similarity between the two species is sufficiently great for them to have been confused with each other in several collections, but the differences of the aedeagi suggest a relatively long independent history.

The aedeagus of *M. costellus* is rather like that of *M. opaculus*, but there are few similarities in other respects. There are similarities between *M. costellus* and *M. lateralis*. The latter species is easily distinguished from all populations of *M. costellus* by its more slender aedeagus, smaller and shallower punctures, smaller elytral and prosternal granules, presence of granules on the pronotum, including the disc, and by its broader and less convex form. In short, the relationship to *M. lateralis* is comparatively remote.

MALE

Dorsal surface. Antennae as in *M. granulosus* except for terminal segment, which is less elongate (about 1.2 x broader than long). Labrum emarginate. Head of same shape as in *M. granulosus*, but diameter of punctures larger, and interstices more uneven.

Pronotum approximately as in Fig. 51, very rarely with a sinuation in front of posterior angles. Disc more closely punctured than in *M. granulosus*, microsculpture strong, interstices very uneven, especially in submarginal channels, where they are almost granulate. Scutellum very closely punctured.

Elytra convex, submarginal channel concave, epipleural carina barely reflexed. Three primary costae clearly visible: towards apex these are composed mainly of rows of large granules but the basal part of each is composed of a distinctly raised ridge, which bears granules on its crest. Between each costa are rows of large granules, which appear as secondary costae to the naked eye. Punctation of elytra like that of *M. granulosus*, but interstices more uneven, frequently bearing small granules in addition to the large ones mentioned above. Punctures of lateral and hind slopes bear short erect setae, just visible at 25 x magnification. Microsculpture of interstices between costae strong, visible at 25 x magnification; granules and elevated parts of costae shining, without discernible microsculpture.

Ventral Surface. Mentum less transverse than in *M. granulosus*. Interstices between punctures of prosternum very uneven, and bearing some distinct granules laterally. Posterior part of intercoxal process (Fig. 92) much more prominent than in *M. granulosus*. Proepisternum bearing distinct small granules near its inner edge as well as a few near the outer edge.

Mesosternal intercoxal process (Fig. 92) very narrow, slightly narrower than in *M. granulosus*, submarginal grooves more distinct, median part more convex, its punctures very fine.

Punctures of lateral parts of metasternum and abdominal sternites relatively larger and deeper than in *M. granulosus*. Epipleura of elytra bearing sparse, very fine punctures and small granules, microsculpture strong.

Legs. Outer apical angle of front tibia prominent, as in *M. granulosus*, spines smaller than in *M. granulosus*, other tibiae lacking spines, punctures relatively small and interstices smooth.

Aedeagus (Fig. 93). Much stouter than in *M. granulosus*. In dorsal view apicale broad and blunt. Basale with sides almost straight and subparallel, converging slightly to apex. Stout in lateral view.

FEMALE

Like male, but legs more slender and relatively shorter.

DIMENSIONS

Range. Length 10.6-17.2 mm; width 5.7-8.9 mm.

GEOGRAPHICAL VARIATION

There is slight geographical variation in the convexity of the mesosternal intercoxal process, the curvature of the aedeagus, and the size and depth of punctures on the ventral surface.

TYPE MATERIAL. Holotype ♀ 19.0 x 9.2 mm BMNH.

TYPE LOCALITY. "North Canterbury", here restricted to Loburn, about 18 miles north of Christchurch, as the type closely resembles specimens from this locality.

Material examined. Holotype ♀, 45 other specimens.

Loburn, Ashley HQ, Rangiora, Waipara, Boby's Stream, Waipara R., White Rock, Mt Grey, East Grey River.

Distribution. Canterbury north of Christchurch, southern Marlborough.

Apparently confined to a fairly restricted area north of Christchurch. The specimens from Rangiora were found near a cinder path in a neglected garden (Dr D. Spiller pers. comm.).

Mimopeus impressifrons (Bates, 1873) (Figs. 84,85)

impressifrons Bates, 1873, Ann. Mag, Nat. Hist. (4)12:485 (*Cilibe*); Broun, 1880, Man. N.Z. Col. 1:376 (*Cilibe*); Watt, 1968, N.Z. Ent. 4(1):39 (*Mimopeus*).

Similar to *M. elongatus* in some respects, particularly pronotal sculpture, but hardly likely to be confused with it. Readily distinguished from *M. tibialis* by the apex of the front tibia (Figs. 85,100). The outer angle is not strongly dentate and the sinus beside it is lacking. The aedeagi (Figs. 84,99) are quite different in the two species, the pronotal punctures are larger, deeper and more distinct, and the mesosternal intercoxal process is narrower in *M. tibialis* than in *M. impressifrons*. There is a striking superficial resemblance in form between *M. tibialis* and *M. impressifrons*, and the two species were found to have been confused in several collections. The structure of the anterior tibia is completely reliable for separating them.

Readily distinguished from *M. opaculus* by the narrower, more elongate form, greater convexity, narrower (often obsolete) elytral submarginal channels, smaller and shallower pronotal punctures, absence of granules anywhere on the dorsal surface, less prominent prosternal intercoxal process and by the structure of the aedeagus. There is a slight overlap in dimensions (minima for *opaculus*: length 13.1; width 7.2 mm).

MALE

Elongate oval, moderately convex. Upper surface black or reddish, undersurface shining reddish black.

Dorsal surface. Labrum slightly emarginate anteriorly, finely and closely punctured, puncture bearing yellow bristles which are longer and stouter towards sides, microsculpture strong, clearly visible at 25 x magnification. Punctures of the clypeus rather fine, not very deep, punctures of genae and front rather coarser and deeper but separated by more than their own diameter, interstices flat, micropunctures very small, barely visible at 100 x magnification, microsculpture fairly strong, visible at 25 x magnification. As implied by the name the types all bear a distinct transverse impression on the frons between the eyes, but this character is not at all diagnostic of the species, being present in very few other specimens examined, and then usually faintly.

Fourth antennal segment 3/5 as long as third, terminal segment slightly longer than broad.

Pronotum convex, sides strongly curved, submarginal channels obsolete, anterior emargination shallow, anterior angles blunt, posterior angles barely acute (ca. 85°). Punctures fine or very fine, shallow, becoming deeper towards sides and base, mostly separated by more than twice their own diameter on disc. Micropunctures just visible at 25 x magnification, microsculpture fairly strong, visible at 25 x magnification. Scutellum very finely and faintly punctured.

Elytra elongate oval, convex, submarginal channels almost obsolete, epipleural carina not reflexed at all. Punctures considerably larger and deeper than those of pronotum, but still separated mostly by more than their own diameter, interstices rounded, longitudinal costae faintly indicated. Microsculpture just visible at 25 x magnification. Hairs not visible at punctures even at 100 x magnification except on lateral and hind slopes.

Ventral surface. All punctures of undersurface very fine and shallow. Mentum convex medially, transverse, almost twice as broad as long. Maxillary emargination (at base of cardo) barely raised, not dentate laterally. Punctures of postgenae fairly fine and shallow. Gula smooth. Prosternal intercoxal process narrow and only slightly convex posteriorly. Punctures of prosternum and proepisternum minute, interstices smooth.

Median part of mesosternal intercoxal process only slightly convex, submarginal channels faint.

Punctures of last two abdominal sternites more distinct than those of remainder of undersurface but still fine and shallow. Hairs of lateral parts of sternites very fine and relatively short.

Legs. Outer angle at apex of anterior tibia moderately dentate, (Fig. 85) but without the deep sinus beside the tooth characteristic of *M. tibialis*. Leg segments moderately punctured, hairs fairly short, interstices smooth.

Aedeagus (Fig. 84). Basale not greatly expanded, apex about as wide as base of basale, sides of basale almost straight, barely sinuate. Not very strongly curved in lateral view.

FEMALE

Like male but more convex and slightly larger, legs relatively slightly shorter.

DIMENSIONS

Range. Length 10.9-17.2 mm; width 5.4-8.3 mm.

GEOGRAPHICAL VARIATION

1. *Clutha Valley and Tributaries*

No specimens identical in all respects with the types have been examined, the specimens differing least are from Cromwell. Specimens from Bannockburn (4.8 km S.E. of Cromwell) and Mt Pisa (12.9 km N.) differ from Cromwell specimens in having slight submarginal grooves developed on pronotum and elytra. A specimen from Obelisk about 32.2 km down the Clutha Valley from Cromwell falls within the Cromwell range of variation.

Oturehua lies in a valley system the Manuherikia which eventually joins the Clutha at Alexandra. In specimens from the vicinity of Oturehua the form is broader, the submarginal channels of pronotum slightly wider, and the punctures of the head larger and deeper than in any of the specimens discussed above, but in other respect there are no notable differences.

Wedderburn, the type locality of *M. lewisianus*, is situated only 9.6 km east of Oturehua, but in the completely different valley system which drains into the Taieri River. It is difficult to correctly attribute specimens to *M. impressifrons* or *M. lewisianus*.

Specimens from Queenstown which lies near the outlet of Lake Wakatipu into the Kawarau River (a tributary of the Clutha) resemble Cromwell specimens in most respects, but the aedeagus is stouter and there are narrow pronotal and elytral submarginal channels.

2. *Mackenzie Basin Populations*

Specimens from Lake Pukaki and Lake Tekapo are remarkably similar in general form to individuals from the vicinity of Cromwell. The sides of the pronotum are slightly less strongly curved, the pronotal punctures are generally slightly larger and deeper, and there are a few small granules on prosternum and proepisternum. The aedeagus is slightly shorter and broader than in most Clutha Valley specimens.

TYPE MATERIAL. Lectotype ♂ 14.1 x 6.2 mm BMNH. Selected from a series of three syntypes, designated and labelled as such: New Zealand. *Cilibe impressifrons* Type F. Bates. F.B./B.M. 81-19.

Paralectotypes 2 ♀ 14.2 x 7.4 mm, 14.0 x 7.2 mm. With same data as lectotype, F.B./B.M.

TYPE LOCALITY. "New Zealand", here restricted to Central Otago. The types were probably collected somewhere in the Clutha Valley near Cromwell (see discussion of geographical variation above).

Material examined. Lectotype ♂, 2 paralectotypes ♀, 119 other specimens.

Cromwell, Bannockburn Otago, Mt Pisa near Cromwell, Queenstown, Obelisk, Simon Hill S. Cantab., Lake Pukaki, Mt John Tekapo, Army Camp Lake Tekapo, Black Forest Benmore Pass, Rough Ridge Oturehua, Oturehua Reservoir.

Distribution and Ecology. Middle Clutha Valley, Queenstown and vicinity of Oturehua, Central Otago, Mackenzie Basin, South Canterbury.

Adults found under stones and in screes in light sandy soils derived from loess. Larvae in similar soils and in tussock debris in the vicinity of Cromwell (see Watt 1979). Collected at altitudes of 914-1066 m (3000-3500 ft).

Mimopeus lewisianus (Sharp, 1903)

lewisianus Sharp, 1903, Ent. Mon. Mag. 39:108 (*Cilibe*); Watt, 1968, N.Z. Ent. 4(1):39 (*Mimopeus*).

MALE

Like *M. impressifrons* but less convex, poorly defined but relatively broad submarginal channels present on pronotum and elytra, epipleural carina produced laterally forming a distinct flange, but barely reflexed. Macropunctures of pronotum larger and deeper but relatively small, mostly separated by more than their own diameter, micropunctures also larger and deeper. Punctures of postgenae and all sternites larger and deeper, hairs of undersurface longer. Aedeagus very similar to that of the type of *M. impressifrons*, apicale slightly more elongate.

FEMALE

Like male, but slightly broader, legs slightly shorter relatively. This species is similar to but smaller and more elongate than inland specimens of *M. opaculus* from the upper Taieri.

DIMENSIONS

Range. Length 12.8-17.1 mm; width 6.2-7.8 mm.

GEOGRAPHICAL VARIATION

Slight, not studied in detail.

TYPE MATERIAL. Lectotype ♂ 14.1-6.8 mm BMNH. Selected from a series of 9 syntypes, designated and labelled as such: Wedderburn, Lewis, 1901. *Cilibe lewisiana* Type D.S. D.S./B.M. 1905-313.

Paralectotypes (4♂, 4♀) with same data as lectotype, but labelled "Ind.Type" or without determination labels. D.S./B.M. As all the above specimens are labelled in the same (Sharp's) handwriting it is reasonable to assume that they were before Sharp when he described the species and thus are to be regarded as syntypes.

TYPE LOCALITY. Wedderburn, Otago.

Material examined. Lectotype ♂, 8 paralectotypes, 21 other specimens.

Otago, Central Otago, Copburn, Base of Mt Ida.

Distribution. The only locality records at present acceptable are all in Otago.

M. lewisianus has similarities to both *M. opaculus* and *M. impressifrons* but is probably more closely related to the former. In the key in Part 1 it would trace to *M. opaculus*. It is distinguished from that species in that it is smaller and more elongate.

Mimopeus tibialis (Bates, 1873) (Figs. 97-100)

tibialis Bates, 1873, Ann. Mag. Nat. Hist. (4) 12:484 (*Cilibe*); Broun, 1880, Man. N.Z. Col. 1:376 (*Cilibe*); Watt, 1968, N.Z. Ent. 4(1):39 (*Mimopeus*).
velox Sharp 1903, Ent. Mon. Mag. 39:108 (*Cilibe*).

Not closely related to any species. The strongly dentate anterior tibia is characteristic also of *M. rugosus* and *M. convexus*, although the tooth is sharper in *M. tibialis* (Figs. 100 and 101); but the relatively stout aedeagus of *M. tibialis* immediately excludes it from any close relationship with these two species. However, *M. convexus* is remarkably similar to *M. tibialis* in general form and punctation. The dentate maxillary emargination is unique in the genus, but this character is exhibited by a number of Australian Nyctozoilini which however, are not closely related to *Mimopeus*. *M. tibialis* shows relationships to the *granulosus* species group through *M. johnsi*; which however lacks the characteristic dentate anterior tibia and maxillary emargination, and possesses clearly defined elytral submarginal channels.

MALE

Elongate oval, convex, dull reddish brown or reddish black, undersurface shining dark reddish brown.

Dorsal surface. Labrum rounded anteriorly or barely truncate, finely and closely punctured anteriorly and laterally, centre almost impunctate. Each puncture bears a fairly fine yellow seta : these become longer and stouter on the sides. Head moderately broad, eyes extending further laterally than genal canthus. Clypeus slightly emarginate anteriorly, clypeal sutures faint. Punctures between eyes distinctly impressed but relatively shallow, separated by about their own diameter, interstices rounded; microsculpture just visible at 25 x magnification; micropunctures very small, barely visible at 100 x magnification. Punctures smaller and shallower anteriorly.

Pronotum convex, anterior angles very blunt, anterior emargination shallow. Posterior angles acute (ca. 70°) and sharp. Thickened margin extends almost to mid-line anteriorly. Submarginal channels quite obsolete. Punctures fairly large, deep and steep-sided, but edges

rounded and interstices fairly smooth; microsculpture scarcely visible at 25 x magnification. Punctation coarsest and most dense near base, with punctures becoming quite small and shallow near anterior angles. Each puncture bears a fine short yellow seta, but these are difficult to see except towards base, and then only at 100 x magnification. Micropunctures small, just visible at 25 x magnification. Scutellum smooth, shining, very finely punctate.

Elytra elongate oval, moderately convex. Basal carina fairly sharp, slightly raised laterally; shoulders narrowly rounded. Submarginal channels narrow, almost obsolete; epipleural carina not reflexed outside them. Punctures rather smaller and shallower than those of pronotal base; interstices smooth, lacking granules. Longitudinal costae faint.

Ventral surface. Emargination at base of cardo raised laterally to form a distinct tooth (Fig. 97 *t*). Mentum about 1.5 x broader than long, convex anteriorly, rather finely punctate. Pregular region of postgenae bearing round, deep punctures separated by about their own diameter; gular region with small, laterally elongate punctures set in transverse furrows. Gula smooth, shining, with a few irregular transverse grooves. All punctures of ventral surface bear fine yellow setae, mostly 2 x or 3 x the diameter of the punctures in length.

Prosternal intercoxal process slightly bulbous posteriorly. Prosternum bearing sparse fine punctures, very fine on intercoxal process, separated by several times their own diameter, each bearing a very fine, short seta; interstices smooth, shining; microsculpture scarcely visible at 25 x magnification. Sculpture of proepisternum similar. Sculpture of meso- and metasternum like that of prosternum, but setae much longer on lateral areas. Mesepisternum faintly punctate. Median part of mesosternal intercoxal process fairly broad and almost flat, submarginal channels only slightly broadened posteriorly. Epipleura smooth, finely punctate.

Sculpture of first three visible abdominal sternites like that of thoracic sterna; fourth and fifth sternites with deeper and closer punctation.

Legs. Outer angle of anterior tibia (Fig. 100) forming a distinct tooth, with a distinct "sinus" (emargination of the apical margin) beside it. Surfaces of legs smooth, rather finely punctured, without granules on interstices, but rather uneven on under surfaces of tibiae. Coxae bearing rather fine and fairly short pubescence.

Aedeagus (Fig. 99). In dorsal view basale stout; base of apicale broad, tips of parameres convergent and barely separated. In lateral view basale stout, apicale curved slightly upwards.

FEMALE

Unusually distinct from male in this species : broader, more convex, and larger: readily distinguished without dissecting out genitalia.

DIMENSIONS

Range. Length ♂ 10.4-12.3 mm; width 5.6-6.4 mm. Length ♀ 12.7-14.2 mm; width 6.4-7.6 mm.

GEOGRAPHIC VARIATION

The description applies to the types and other specimens from the vicinity of Christchurch. Limited material has not permitted a detailed study of geographical variation. The variation outlined below is almost certainly geographical, however.

1. Punctation. In specimens from northern Canterbury, and especially in those from southern Canterbury, both dorsal and ventral punctures are smaller, and in southern specimens shallower.

2. Microsculpture. Stronger in Southern Canterbury specimens.
3. Aedeagus. Base of apicale and apex of basale more slender in dorsal view in specimens from Ashburton Gorge and Fairlie (S. Canterbury).

The male type of *Mimopeus velox* Sharp resembles specimens from South Canterbury in all these respects, and it is highly probable that the locality "Christchurch" on its label and in Sharp's description (1903) is erroneous. The specimen is less convex than any other *M. tibialis* examined, but cannot be separated specifically from the other individuals.

TYPE MATERIAL. Lectotype ♂ 12.3 x 5.9 mm. Selected from a series of 5 syntypes, designated and labelled as such. Chch., N.Z., *Cilibe tibialis*. Type, F. Bates. C.M. Wakefield, Chch., N.Z., F.B./B.M. 81-19.

Paralectotype ♂ Chch., N.Z., *Cilibe tibialis* Type, F. Bates. D.S./B.M. 1905-313.

Paralectotypes (3 ♀). New Zealand *Cilibe tibialis*. Type, F. Bates. F.B./B.M. 81-19.

Holotype ♂ (unique) of *velox* Sharp 12.6 x 5.5 mm BMNH. *Cilibe velox*, Type D.S., Christchurch.

TYPE LOCALITY. "New Zealand" (Bates, 1873). As some of Bates' syntypes are labelled "Christchurch", and as specimens collected from localities near that city closely resemble the types, the type locality is here restricted to Christchurch.

Material examined. Lectotype and 4 paralectotypes, holotype of *Cilibe velox*, 48 other specimens.

Balmoral S.F., Waipara, Mt Grey, Eyrewell, Kaiapoi, Dyers Pass, Lyttelton, Christchurch, Rakaia River, Ashburton Gorge, Fairlie, MacKenzie Pass.

Distribution. Apparently confined to Canterbury *M. tibialis* occurs in the pine forests of Balmoral and Eyrewell, but apart from this nothing is known of its biology. *M. tibialis* is common in the Bankside Reserve of lowland tussock-grassland near Christchurch (Dr R.M. Emberson pers. comm.).

Mimopeus rugosus (Bates, 1873) (Figs. 48,101,104)

rugosus Bates, 1873, Ann. Mag. Nat. Hist. (4) 12:483-4 (*Cilibe*); Broun, 1880, Man. N.Z. Col. 1:375-6 (*Cilibe*); Watt, 1968, N.Z. Ent. 4(1):32 (*Mimopeus*).

Related to *M. convexus*, from which it is easily distinguished by its larger and deeper punctures; the presence of bristles rather than fine setae on the lateral and hind slopes of elytra; longer and stouter ventral setae; much more distinct elytral costae; much stronger microsculpture; and lighter reddish-grey colour.

MALE

Elongate oval, convex. Colour dull reddish grey; underside, legs and antennae reddish. Punctures filled with greyish matter which on elytra frequently covers entire interstices between costae.

Dorsal surface. Labrum slightly emarginate anteriorly, finely punctured; bearing fine, relatively long yellow setae. Macropunctures of front very large, deep and steep-sided, finer on clypeus and vertex; those of frons bearing short stout setae (about length of diameter of puncture) clearly visible at 25 x magnification. Interstices uneven, microsculpture strong, visible at 25 x magnification; micropunctures relatively large and deep, mainly visible at 25 x magnification.

Pronotum moderately convex, less so than in *M. convexus*; submarginal channels present but narrow and indistinct; fairly deep lateral basal depressions usually present. Macropunctures large, deep and steep-sided, always separated by less than their own diameter, except on small impunctate areas on the disc in some specimens; each bearing a short, usually recumbent seta. Interstices uneven; microsculpture strong; micropunctures relatively large, clearly visible at 25 x magnification. Lateral marginal thickenings bear a dense covering of small bristles, just visible at 25 x magnification. Scutellum bearing small deep macropunctures; micropunctures just visible at 25 x magnification.

Elytra convex, elongate oval. Basal carina distinct, raised; shoulder narrowly rounded but not prominent. Submarginal channels narrow and obsolete, inner angle not defined, epipleural carina not reflexed at all. Primary costae distinct and raised from base almost to apex, clearly visible to naked eye. Macropunctures of interstices between costae large and deep, frequently running together to form irregular foveae, interstices between them very uneven. Macropunctures of costae smaller. Micropunctures relatively large and deep, clearly visible at 25 x magnification, even on costae. Microsculpture strong, clearly visible at 25 x magnification. Each macropuncture bears a small yellow bristle clearly visible at 25 x magnification. Those of disc are short and recumbent, those of lateral and hind slopes are longer and project backwards at an angle of about 45° to the elytral surface.

Ventral surface. Punctures of mentum, cardo, stipes and pregular region of postgenae relatively large and deep; those of gular region smaller and shallower, bearing fine, short, recumbent yellow setae; interstices uneven, almost granulate. Punctures of prosternum, proepisternum, depressed part of mesosternum, mesepisternum, mesepimeron, metasternum, metepisternum and first three abdominal sternites relatively large and deep, each bearing a yellow seta, these being longest on metasternum and abdominal sternites. Punctures of raised part of mesosternum and last two abdominal sternites smaller and shallower. Prosternal intercoxal process flat betwene coxae, projecting moderately posteriorly. Mesosternal intercoxal process relatively narrow.

Legs. Outer apical angle of front tibia projecting strongly to form a blunt tooth, with a definite "sinus" between it and the articulation of the basal tarsal segment (Fig. 101). Legs relatively finely punctured, interstices fairly smooth.

Aedeagus (Fig. 104). In dorsal view apicale very slender, basale slender at apex but broadening rapidly, much stouter towards base. In lateral view apicale very slender, basale slender at apex but becoming much stouter towards base.

FEMALE

Like male but broader and more convex; legs relatively shorter and more slender.

DIMENSIONS

Range. Length 10.7-12.6 mm; width 5.6-6.6 mm.

GEOGRAPHIC VARIATION

This species seems to be fairly rare, and little material has been examined. There is considerable individual variation in shape and size; and in sculpture to a small extent. There appears to be little geographical variation in comparison with other species with an extensive distribution, as far as I can judge from the limited material.

TYPE MATERIAL. Holotype ♂ (unique) 11.9 x 5.1 mm BMNH. New Zealand, *Cilibe rugosa* type, F. Bates. F.B./B.M. 81-19.

TYPE LOCALITY. "New Zealand". The type is unusually elongate, but corresponds most closely to specimens from Hyde, in Otago, of the material examined.

*Material examined.*Holotype, 20 other specimens.

Peel Forest, Temuka. Upper Wedderburn base of Mt Ida, Central Otago. Wallacetown.

Distribution. South Canterbury, Otago, Southland. Biology unknown.

Biogeography and Ecology

It is quite unrealistic to discuss the distribution of any members of the fauna or flora in New Zealand without bearing in mind the extreme climatic changes which took place during Pleistocene times (Willett 1950, Fleming 1962). These caused considerable changes in the distribution of the vegetation, as shown by pollen studies, and must also have profoundly influenced the distribution of animals. In post glacial times there have been lesser climatic changes which are still affecting the distribution of vegetation, as was elegantly demonstrated by Holloway (1954). One must therefore take a dynamic, not a static view of biogeography in New Zealand.

Unfortunately there is no known fossil record of *Mimopeus* so that the history of the species of the genus can only be inferred from present distribution, ecology, and known geological history of New Zealand. As the adults are flightless, physical barriers to migration assume much greater importance than in animals with more effective means of dispersal. In most instances, the only way in which populations could have reached their present habitats is by walking.

Four species, *M. elongatus*, *M. buchanani*, *M. opaculus* and *M. humeralis* occur in the North I mainland, but only the latter is not known to occur also in the South I.

M. turbotti is confined to the Three Kings Is, *M. insularis* to the Poor Knights Is and *M. pascoei* and *M. subcostatus* to the Chatham Is. The remaining 13 species are all confined to the South I mainland.

The elongatus *species group*

Comprising *M. elongatus* and *M. neglectus*. The distributions of *M. elongatus* and of *M. neglectus* are shown in Fig. 106. There is a concentration of records near Auckland which is due mainly to a concentration there of collecting activities. There

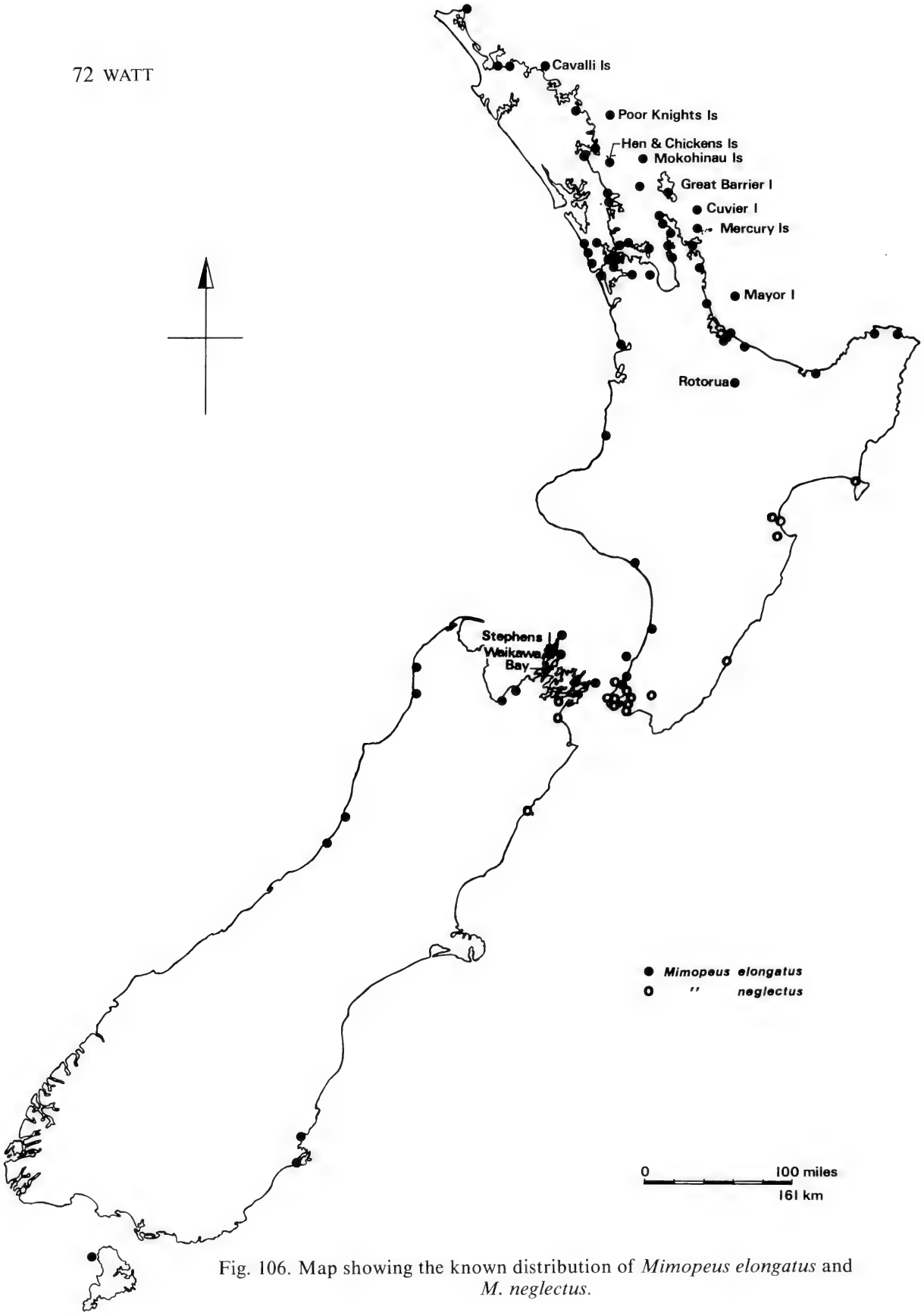

Fig. 106. Map showing the known distribution of *Mimopeus elongatus* and *M. neglectus*.

are few sandy beaches on the North I coast where *M. elongatus* cannot be found, especially if *Muhlenbeckia complexa* is present. The observed association between *M. elongatus* and this plant deserves further investigation. Perhaps optimum microclimatic conditions for many of the populations occur under these plants, and therefore they concentrate themselves there rather than under other dune plants. It does not seem very likely that the association is due to narrow feeding preferences (stenophagy), which are unusual in Tenebrionidae, especially those like *Mimopeus* with soil-inhabiting larvae. *M. elongatus* is found on boulder beaches and other stony shores, and in the craters of Auckland's extinct volcanoes, usually under stones, but once again almost always in association with *Muhlenbeckia complexa.* Elsewhere all the records are coastal except for some from the vicinity of Rotorua. *M. neglectus* differs from *M. elongatus* in not showing any preference for *Muhlenbeckia complexa*, and is more likely to be found under other coastal plants. It occurs inland at Hastings and Rissington in Hawkes Bay.

The only common factor for all the habitats in which *M. elongatus* occurs is a well-drained substrate. The larvae require loose, well-drained sandy soil, or well-drained humus amongst boulders and stones, and are never found in hard clay soils, forest soils, or in water-logged soils of any kind. This effectively explains the almost exclusively coastal distribution of the species in the North I, but does not account for its restricted distribution in the South I.

The relationship of morphology to habitat in *M. elongatus* has been discussed previously. It was found that, generally speaking, adults inhabiting vegetated dunes of sandy beaches lack pronotal granules or have them weakly developed, and the pronotal microsculpture is weak. Those living amongst stones usually have stronger pronotal granules and microsculpture.

West Coast populations of *M. elongatus*, always found on dunes, lack pronotal granules and have weak pronotal microsculpture. The same rule seems to apply to Cook Strait populations of *M. elongatus* in which the island populations have stronger granules and microsculpture than the mainland dune inhabiting population. Otago and Stewart I populations of *M. elongatus* have weak microsculpture, and live on sandy beaches. The exception in this as in other respects is *M. neglectus*, which usually lives on stony beaches, but lacks granules on pronotum and disc of elytra, and has weak microsculpture.

Mimopeus elongatus is present on all the northern offshore islands (with the exception of the Three Kings), and on most of the Cook Strait islands. None of these island populations has diverged to any great extent, although they frequently seem to be more variable geographically than mainland populations. All these islands were connected to the mainland during the last glaciation (Fleming 1962, fig. 11), except for the Poor Knights Is and Mayor I. The latter is marked by Fleming (1962) as "mainly postglacial", but according to Brothers (1957) some of the northern part of the island was terraced by a high interglacial sea-level. The main question here is whether or not any earlier fauna could have survived the last devastating (apparently postglacial) eruption. If not, the present fauna, including *M. elongatus*, would have reached the island since that time, across the sea. The occurrence of normal *M. elongatus* on the Poor Knights Islands is interesting in view of the presence of the endemic *M. insularis*

there together with other endemic (mainly undescribed) insects (Watt 1982). Probably *M. elongatus* first reached the Poor Knights during the last glaciation, when the sea barrier was much narrower than at present, or there was a substantial influx then which "swamped" any distinctive characters of earlier migrants.

It appears that *M. elongatus* is the only species of *Mimopeus* which may have crossed a salt water barrier. It is coastal and is thus probably more tolerant of salinity than other members of the genus. Transport by birds seems unlikely, so one is left with the probability of chance transport on some form of vegetation raft (probably of adults, which would be more capable of keeping themselves relatively dry than any of the immature stages). Accidental transport by man seems unlikely.

M. turbotti is confined to the Three Kings Is. It is closely related to *M. elongatus*, and has apparently speciated in isolation. Its presence on the Three Kings is not evidence of a former land connection with the mainland, although it suggests that the water gap was probably less in the past than at present. A large land snail, *Placostylus bollonsi* Suter is endemic to the islands, and apparently requires land for dispersal (Powell 1948). The fact that populations of *M. elongatus* isolated on islands by rising sea-levels after the last glaciation have diverged only slightly, indicates that the ancestors of *M. turbotti* must have been isolated in the Three Kings area for a much longer period. Much of the terrestrial fauna of the Three Kings Is has not been described, but the following figures have been compiled from the literature published so far (mainly in the *Records of the Auckland Institute and Museum*). A total of 162 species have been stated to occur there, and of these 53 species and 5 subspecies are apparently endemic. If birds are excluded, these figures become 120, 53 and 4; i.e., there is almost 50% endemism, a figure not approached by any other island group off the North I coast. This suggests prolonged and effective isolation from the mainland, perhaps since upper Miocene times (Fleming 1962, fig. 9).

M. pascoei is less closely related to *M. elongatus* than is *M. turbotti*, and has certain affinities with the *humeralis* superspecies, suggesting an earlier divergence. There is no certainty that the Chatham Is were ever connected to the mainland, and the presence of a species there related to the euryhaline *M. elongatus* does not provide strong support for a land connection.

M. thoracicus is by far the most widely distributed species of the *humeralis* superspecies (Fig. 107). It is predominantly coastal and extends from Cape Campbell to Dunedin. It replaces *M. elongatus* on the coast of Southern Marlborough and Canterbury, and is found in similar habitats. The other species have much more restricted ranges. *M. vallis* (Fig. 107) occupies the lower parts of the dry, tussock-clothed Awatere Valley. *M. parvus* (Fig. 107) is at present known only from Molesworth, in the upper Awatere Valley and Mt Percival, near Hanmer, at altitudes above 914 m (3000 ft). *M. parallelus* (Fig. 107) seems to be confined to the lower part of the Clarence Valley. *M. humeralis* (Fig. 107) is the only species of the *humeralis* superspecies confined to the North I mainland, where it has a limited range along the Wellington south coast.

These species are all closely related to each other except for *M. parallelus*, and (with the possible exception of the latter) all probably originated during the

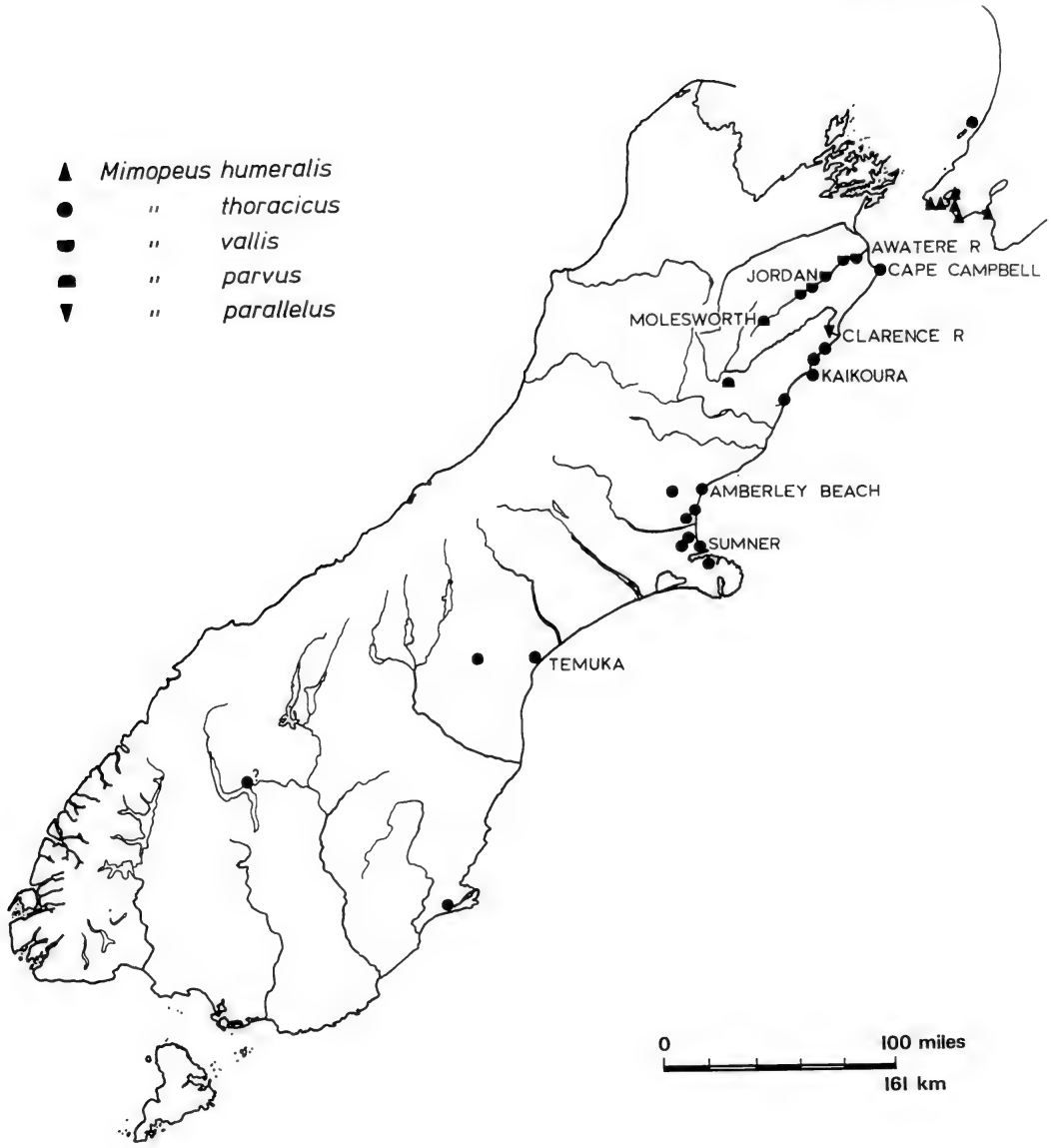

Fig. 107. Map showing the known distribution of the *Mimopeus humeralis* superspecies.

Pleistocene. The ancestral species was probably similar ecologically to *M. thoracicus* and *M. humeralis*, i.e., it was confined to fairly dry coastal areas. The Kaikoura Orogeny, which reached its climax in Pliocene times, built the Kaikoura Ranges, together with the Clarence and Awatere Valleys. It is not improbable that a coastal species would be able to migrate into such valleys, occupying dry gravel terraces beside the river and tributaries, in much the same sort of habitat as that occupied by *M. parallelus* today. It would be "pre-adapted" to this type of habitat which was probably biologically largely vacant. Such a population could easily become isolated in a valley, and rapidly evolve adaptations to fit it better for its new habitat.

The onset of the first glaciation would allow the ancestor of the other species to move northwards. It may have reached southwest Wellington, and possibly further north. The main sea barrier of the first interglacial seems to have been the Manawatu Strait rather than Cook Strait, and it could be that the isolation and speciation of *M. humeralis* took place during the first or second interglacial period north of the Manawatu Strait, although it seems more likely that it evolved in or near its present position during the last interglacial, when presumably Cook Strait was flooded.

M. vallis may also represent a descendent of an isolated remnant population left behind in the south following northward migration of the main body of an ancestral species, but it is more likely to have speciated in isolation in the Awatere Valley, probably during an interglacial.

During the last glaciation, at least, it would seem that *M. thoracicus* was not displaced entirely from Canterbury. The present pattern of geographical variation seems to indicate a group of rather similar populations near Christchurch, and another near Kaikoura, with presumably clinal variation in between (Fig. 107). This may indicate that populations remained on Banks Peninsula and near Kaikoura (or possibly the latter migrated further north), but were temporarily eliminated from the shore of the rapidly aggrading outwash plains of Canterbury. If this did not happen, it is difficult to explain why specimens from Christchurch and Kaikoura differ as much from each other as they do, unless these differences have evolved in postglacial times. There may also have been an isolated group in South Canterbury, but so little is known of populations from there that this must at present be speculative.

To summarise, the most probable history of the *humeralis* superspecies involved an ancestral coastal species, populations of which entered the Awatere and Clarence Valleys, eventually becoming *M. vallis* and *M. parallelus*. During the earlier glaciations the ancestral species moved northwards, leaving behind an isolated remnant in the south of its range, which of necessity became cold-adapted in order to survive, and in the next interglacial moved into the mountains. During an interglacial, the ancestors of *M. humeralis* became isolated by eustatic rise of sea-level. This and *M. thoracicus* are the present coastal species, and the latter seems to have survived the last glaciation on Banks Peninsula and somewhere in the northeast of the South I. On morphological distinctness, the first species to diverge was *M. parallelus*, followed by *M. parvus* and *M. humeralis*, while *M. vallis* and *M. thoracicus* were the last to become differentiated.

At this stage it is necessary to return to *M. elongatus* which is ecologically very similar to *M. thoracicus*. *M. elongatus* seems to be better adapted to warmth than *M. thoracicus*, as indicated by its present distribution (Fig. 106).

The *buchanani* superspecies comprises *M. buchanani* and *M. lateralis*. The known distribution of *M. buchanani* and the northern populations of *M. lateralis* are shown in Fig. 108. *M. buchanani* predominantly a coastal species, occurs far inland in the Nelson district, where populations are morphologically distinct from the remainder of the species. *M. lateralis*, on the other hand, is an inland species which has been collected up to 1,525 m (5,000 ft). Speciation would seem to have involved the adaptation of *M. lateralis* to the more extreme climate of inland Canterbury, while *M.*

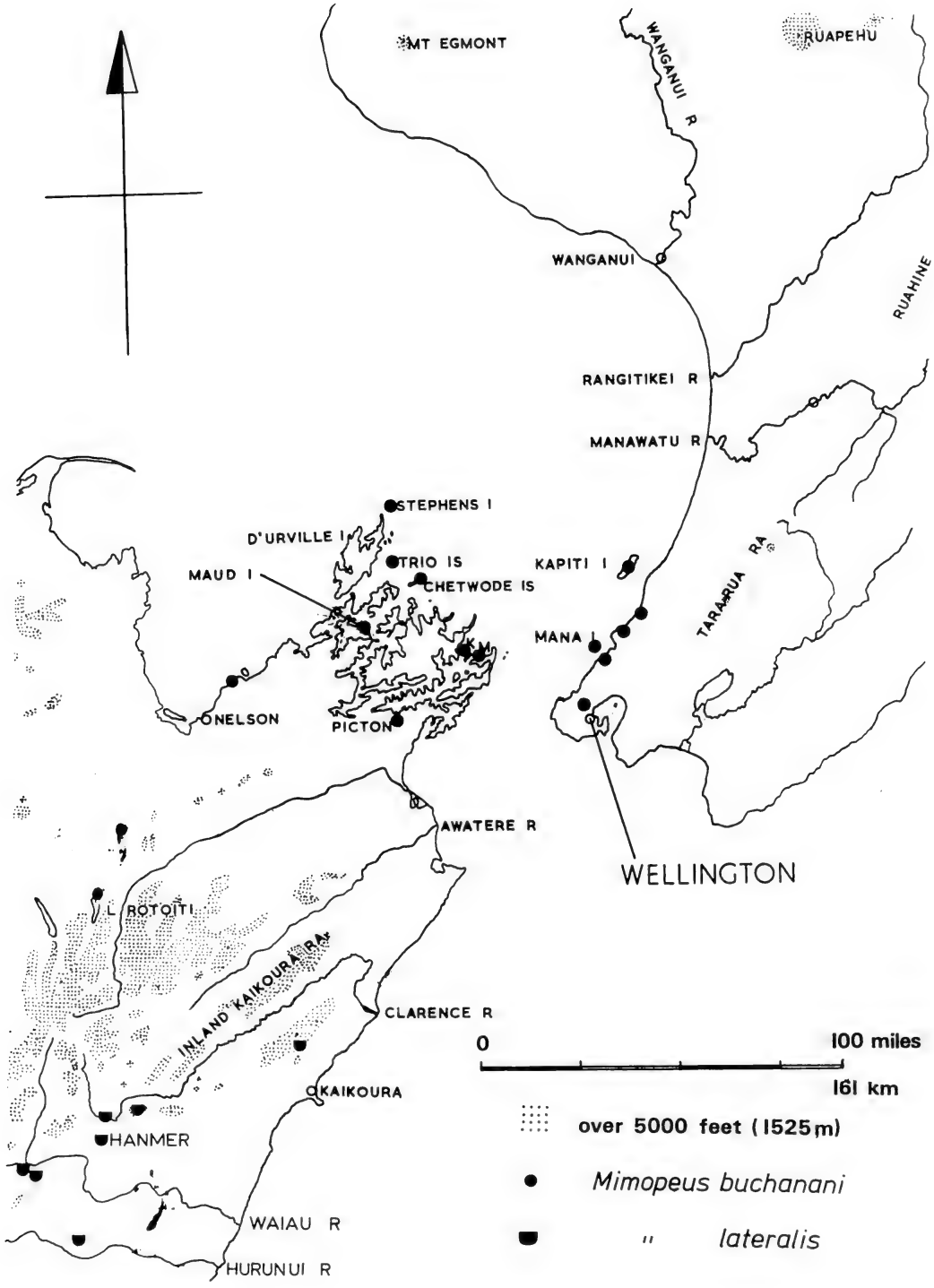

Fig. 108. Map showing the known distribution of *Mimopeus buchanani* and *M. lateralis*.

buchanani became (or remained) adapted to more moderate, damper, climates. The species are at present separated by high mountains (Fig. 108), which formed an impassable barrier in glacial times. It is likely that *M. lateralis* and *M. buchanani* speciated in Pleistocene times. The present distribution and relationships of populations of *M. buchanani* on both sides of Cook Strait (Fig. 108) provides striking confirmation of a land connection between the vicinity of Waikanae and D'Urville I (Te Punga 1953, Fleming 1962, fig. 11).

The opaculus *species group*

M. opaculus is the only member of the genus which has invaded moist forest habitats (although some other species can occur in dry forests). It is absent from the very wet forests of Westland and Nelson and from the subtropical forests of Northland, but otherwise occurs in most forested parts of the country. The species is not confined to forests, occurring under coastal mat plants and stones south of Wellington and on the Cook Strait islands; and in tussock grassland in the MacKenzie Basin. Larvae inhabit fairly dry rotten wood or powdery humus in forests, or live amongst vegetable debris under mat plants on the coast (and probably amongst tussock debris in the MacKenzie Basin). They have not been found below the top, humus-rich horizon of the soil.

M. opaculus is absent from all except the extreme fringes of the area in which soils are derived from the recent, rhyolitic, Taupo and Kaharoa ash showers of pumice sand and gravel (area D of Lee 1959), and apparently does not occur north of the Raukumara Ranges in the east. Other major gaps in the known distribution in the North I may be due to inadequate collecting, although in some areas the forest may be too wet. The distribution of *M. opaculus* has been well surveyed in Canterbury, so its absence between the Waiau and Waimakariri Rivers is real and probably results from extinction during the last glaciation. There are distinct forms of *M. opaculus* in north and mid-Canterbury which never occur far from forests, but suitable habitats were probably absent in Canterbury during the last glaciation. The present distribution and geographical variations of *M. opaculus* suggest that refuges occurred in southern Marlborough, one in mid-Canterbury and one in south Canterbury. The MacKenzie Basin populations possibly became adapted to tussock grassland during the last glaciation. The most likely place for a forest refuge in mid-Canterbury is Banks Peninsula which would have been occupied by a distinct population of *M. opaculus*.

The rather irregular pattern of geographical variation in Otago probably results from populations which have spread out after being isolated in forest or scrub refuges during the last glaciation. The presence of almost identical populations of *M. opaculus* on both sides of Foveaux Strait supports the view that the Strait was dry until the beginning of postglacial times. Stewart I populations of *M. opaculus* presumably survived in a refuge on the island during the last glaciation. *M. insularis* is confined to the Poor Knights Is together with a number of other (mainly undescribed) flightless beetles (Watt 1982). No other island off the east coast of North Auckland has endemic species of beetles as they were connected to the mainland during the last glaciation (Fleming 1962:89). The Poor Knights Is were formed by volcanic activity during Pliocene times, so that ancestors of *M. insularis* may have been isolated since

the early Pleisotocene. The distribution of *M. impressifrons* clearly shows the effects of the last glaciation. It is obvious that *M. lewisianus* must have been isolated from *M. impressifrons* from which it appears to have evolved probably near the mouth of the Shag River or possibly the Taieri River. *M. impressifrons* probably survived the last glaciation in the lower part of the Clutha Valley. Both species have subsequently migrated towards the heads of their valleys and *M. impressifrons* crossed the Lindis Pass into the MacKenzie Basin, probably during the "thermal maximum". *M. impressifrons* and *M. opaculus* probably diverged in late Pliocene or early Pleistocene times.

The granulosus *species group*

The species comprising the *granulosus* species group are confined to Canterbury and Marlborough. *M. granulosus* is endemic to Banks Peninsula, and is sufficiently different from *M. costellus* to indicate a pre-Pleistocene divergence. *M. johnsi* is different from the other two species and is almost certainly pre-Pleistocene in origin although it may have evolved most rapidly under severe selection during glaciations.

The tibialis *and* rugosus *species groups*

Mimopeus tibialis is confined to Canterbury, *M. convexus* to the MacKenzie Basin, and *M. rugosus* has an extensive discontinuous distribution in Canterbury, Otago and Southland. They are not at all closely related but are discussed here together for convenience. Their present distribution gives no evidence of their origin. They possibly all date from mid-Tertiary times judging from their morphological distinctness. The discontinuous distribution of *M. rugosus* is probably due to extinction during glaciations.

Faunal areas

Faunal areas must be regarded with great caution, as there is a danger of accepting them without question, and regarding distributions which do not fit into the pattern, as anomalous. However they have some value in synthesising and summarising distributional data, providing that their boundaries correspond with geographical and/or climatic barriers which produce an effect on the distribution of the group being considered.

Forster (1954: 305) and Lee (1958: 385) have subdivided New Zealand into faunal areas on the basis of the distribution of endemic Opiliones and Oligochaeta respectively. The distribution of species of *Mimopeus* and other genera of flightless beetles fits into Lee's faunal areas better than into those of Forster. In Lee's faunal areas *Mimopeus elongatus* occurs on the coast of all the areas (but is absent from Fiordland, southern Marlborough and most of Canterbury). *M. opaculus* occurs in all areas except G (but is absent from Fiordland, North Auckland and most of area D). *M. humeralis* is confined to area E_1 (to a very limited part of it) and *M. buchanani* occurs in area E_1 and the extreme northest of area G. Ten species are confined to area

F (one to F_1), and three occur in the south of area F and the north of area H. *M. turbotti* is confined to the Three Kings Is, *M. insularis* is confined to the Poor Knights Is, and *M. pascoei* is confined to the Chatham Islands.

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Mr D. Helmore, Entomology Division, Auckland, and Miss R. Gilbert, Auckland Museum, have prepared distribution maps for publication.

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THE FAMILY GYRINIDAE (HEXAPODA: COLEOPTERA) IN NEW ZEALAND

With a description of a northern population

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Abstract. The Gyrinid species now known as *Gyrinus convexiusculus* Macleay, 1871, first described from Australia, was first discovered in New Zealand prior to 1873 by F.W. Hutton and a specimen was described as *Gyrinus huttoni* Pascoe, 1877. The locality given was Waikato, a large area north of the central plateau in the North Island. The same species of whirligig beetles was re-discovered in the Waikato, in lakes in Waipa Co., during the late 1970s. Both occurrences are discussed here and known specimens have been examined.

In early 1983 another population of the same species was found in Mangonui Co. at the northern end of the North I, in man-made 'dams' more than 350 km from the Waipa Co. lakes. This population was monitored from 1983 to early 1987 and again in 1988. The locality is described and the history of the area indicates the dams were most probably constructed in the early 1930s. Results of observations and collections are given.

Two specimens, found recently in the T. Broun collection, were collected in a third area on the northern east coast in Whangarei Co.

Published records and known specimens of the species in New Zealand are recorded and possible origins of the Waikato and northern populations are discussed.

The early history of the records and occurrences of the family Gyrinidae (whirligig beetles) in New Zealand has been sketched by Wise (1983). The only species was described by Pascoe (1877) as *Gyrinus huttoni* from one specimen collected in the Waikato area of the North Island (Fig. 1) by Captain F.W. Hutton. Ochs, in his revision of the Australian Gyrinidae (1949), treated this species as a synonym of the widely distributed *Gyrinus convexiusculus* Macleay, 1971 which he also recorded as the only species of *Gyrinus* in Australia.

Since the discovery in the late 1860s or early 1870s no Gyrinids were collected in the Waikato for over 100 years. Then, in the late 1970s Gyrinids were re-discovered in peaty lakes south of Hamilton, in Waipa County (Chapman 1982).

The discovery of another population of *Gyrinus convexiusculus*, in the far north of the North Island (Mangonui County) was also reported by Wise (1983) and the results of subsequent monitoring were presented at the XXIII SIL Congress in Hamilton, New Zealand, in early 1987 (Wise 1987).

Rec. Auckland Inst. Mus. 26: 83-102 15 December 1989

The research and results on which that paper was based are described here in greater detail together with more information on earlier specimens, occurrences and records, and with additional information on *G. convexiusculus* gained in 1988-1989.

TWO UNSUPPORTED RECORDS

In the scientific results of the Austrian Novara Expedition, Redtenbacher (1868) recorded *Gyrinus striolatus* Guérin, 1830 from "Sidney und Auckland" (1868:24) and "Neu-Seeland" (1868:225) but it is considered that Auckland was an error in labelling or recording. There is no other evidence for this species [now *Macrogyrus striolatus* (Guérin-Ménéville, 1830)], which is the largest (ca.15-18 mm in length) in Australia, occurring in New Zealand or for any Gyrinids being taken at Auckland.

The inclusion of *Gyrinus striolatus* by Hutton in his list of species recorded in New Zealand before 1870 (1874:160) could have been based on Redtenbacher's record and not on any specimens known to him.

Another record, since discredited, is that of *Dineutes australis* [for *Dineutus australis* (Fab., 1775)] in New Zealand by Régimbart (1882:422) followed by Régimbart (1892, 1902) and Ahlwarth (1910). The record of this Australian species (which is ca. 6.5-9 mm in length) for New Zealand was considered doubtful by Ochs (1949:193) and is not accepted here.

THE WAIKATO POPULATION

Historical records

F.W. Hutton (1873) recorded Gyrinids as one of four species of water beetles in New Zealand, under the name of *Gyrinus natator* (of "Britain"), which suggests that he had sighted Gyrinids here by the early 1870s.

This record by Hutton (1873) is here considered to be based on specimens, for which he used the name of a small European species known to him [*G. natator* (L., 1758), ca. 4.5-6.1 mm in length], in contrast to his later record (1874) based on an earlier publication (see above).

Captain F.W. Hutton (1836-1905) came to New Zealand about 1866 and by the time of his death was respected both as a geologist and a zoologist (Anon. 1906). After his arrival he settled in the Waikato district, was appointed to the Geological Survey Department in the late 1860s and subsequently made a geological survey of the Lower Waikato district. A paper, read before the Auckland Institute in May 1871 (Hutton 1872), indicated that he was in the field there at least until April 1871. Thus it is established that Hutton had the opportunity, as well as the interest, to collect specimens of whirligig beetles somewhere in the Waikato, in the late 1860s or early 1870s.

The Waikato region (Fig. 1) is a large, wide valley area (or basin) which surrounds the lower (northern) two-thirds of the Waikato River in the North I. It includes several large swamps and many, mostly small, lakes.

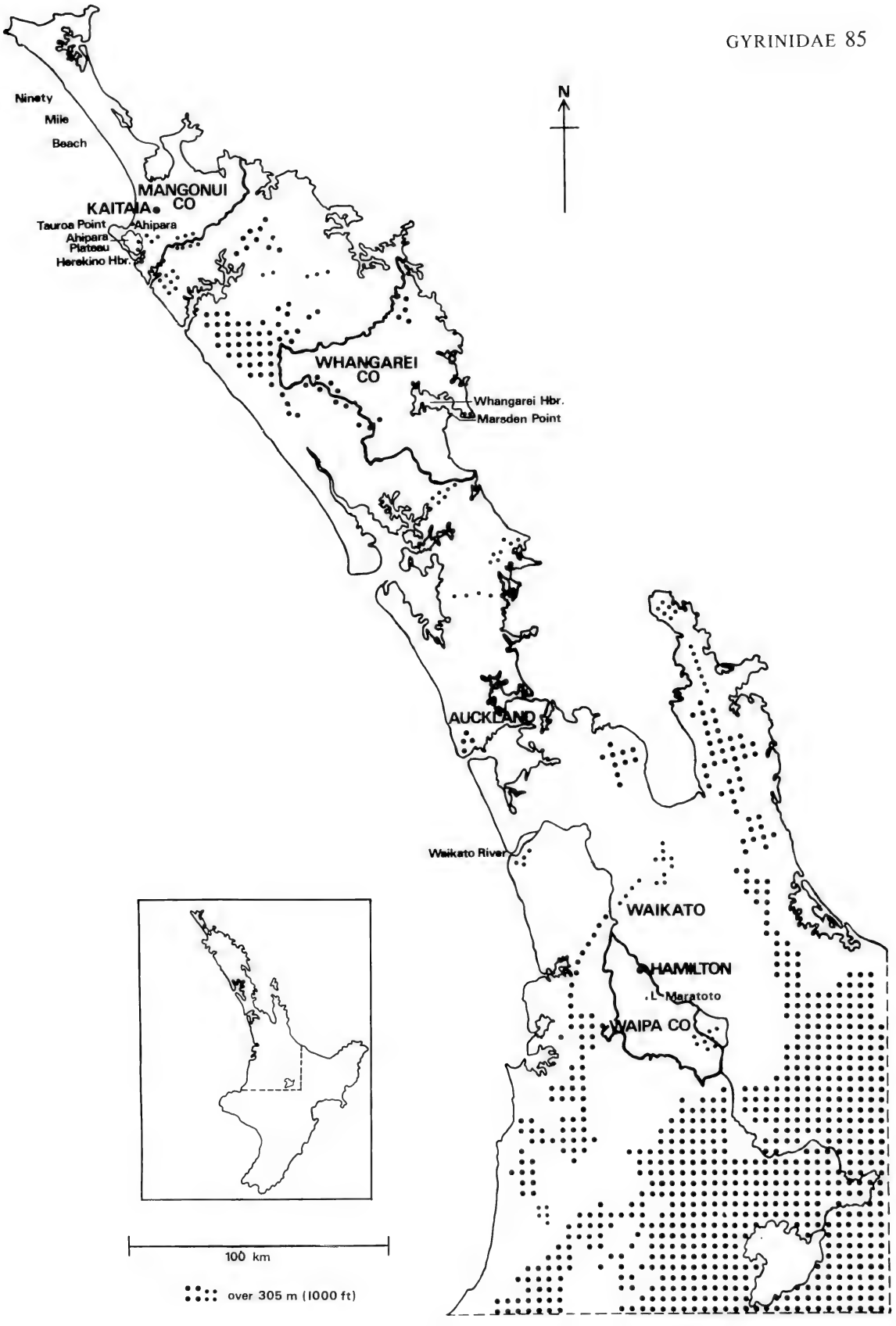

Fig. 1. Northern North I showing localities for Gyrinidae, and other mentioned features. Inset. North I, New Zealand.

Following Hutton's discovery, Gyrinids were not seen in the Waikato for more than a hundred years. Then in the late 1970s, during surveys by Waikato University biologists, the same species (now under the name of *Gyrinus convexiusculus*) was rediscovered there. The particular area was a group of 22 peaty lakes in the Waipa County, some 11-16 km south of Hamilton City (Fig. 1). J.A.T. Boubee and Dr. M.A. Chapman have advised (pers. comm.) that the first sighting of a Gyrinid beetle was at Lake Rotomanuka South in January or February 1977, with a possible sighting of whirligig beetles at L. Mangahia in early 1978, followed by beetle sightings at L. Maratoto in May, June (ca. 30 individuals), August and November 1979. In the last month two Gyrinid larvae were taken at L. Mangahia. Beetles were again seen at L. Maratoto in February and March 1980. Occurrences were where drains entered or exited the lakes, mostly in outlet drains, and only one beetle was seen on open lake water. Clearance of drains at L. Maratoto in late March 1980 caused the lake level to drop and Gyrinids were not seen there subsequently. Beetles taken in 1980 were lodged by M.A. Chapman in the National Museum, Wellington.

The presence of Gyrinids in the lakes was noted in a Limnological Society Newsletter as "whirligig beetles (*Gyrinus,* . . ." by Green, Chapman & Boubee (1979:42) and Green (1979:50). A further collection of three beetles was made by a group of visiting biologists at L. Maratoto in May 1979 and the species was recorded (Anon. 1979:44) as *Gyrinus convexiusculus* Macleay. These specimens were lodged in the Entomology Division, Auckland, by the entomologist in the group Dr T.K. Crosby.

Subsequently, the species was recorded and figured by Winterbourn & Gregson (1981) and Helmore (1982). The Waikato situation and the fauna of the Waipa Co. lakes, including *Gyrinus convexiusculus*, were recorded and discussed by Chapman (1982).

Waikato specimens

Two specimens from New Zealand, both labelled "Pascoe Coll.", were found by the author (in 1987) in the British Museum (Natural History) Entomology collections (BMNH). These are, presumably, both specimens originally collected by F.W. Hutton in the Waikato area.

It is not certain how many individuals were seen or collected by Waikato University biologists. Three specimens, taken at L. Maratoto in March 1980, were lodged in the National Museum (NMNZ) collection.

Three specimens collected by other biologists at L. Maratoto in May 1979 were lodged in Entomology Division collections (NZAC).

Sizes

Known specimens have been sexed and measured as follows.

Pascoe Collection (BMNH)	:	♀	4.5	mm
	:	♂	4.0	mm.
Waikato University collections (NMNZ) [in alcohol]	:	♂	4.4	mm
	:	♂	4.5	mm
	:	♀	4.7	mm.
Other collections (NZAC) [in alcohol]	:	♂	4.3	mm
	:	♂	4.4	mm
	:	♂	4.3	mm.

MARSDEN POINT

Two specimens of *Gyrinus convexiusculus*, labelled as from Marsden Point, have been found recently (1989) amongst mixed "Water Beetles" in the T. Broun collection in the British Museum (Natural History), following an enquiry by the present author.

Marsden Point (Fig. 1) is the southern point of the Whangarei Harbour entrance on the east coast of North Auckland in Whangarei County. It lies approximately 240 km northwards from the Waipa Co. lakes and some 140 km south-east of the Mangonui Co. population area.

It is meaningless to speculate on these specimens. As indicated in another paper (Wise 1988), Broun's labelling was not always accurate and did not include dates. Although he lived on the Whangarei Harbour from 1877 to 1879 (Wise 1988:149-150) and could have collected these specimens at Marsden Pt then, he did not record them in his *Manual* (Broun 1880) or any subsequent publication. He may, however, have collected them later and the locality record is accepted here.

Although Marsden Pt is known as a sandy beach area, the low flat terrain behind the sand-dunes could well have held freshwater ponds in days prior to Broun's death in 1919. There is now an oil refinery on Marsden Pt and drained farmland behind. During recent searches (winter 1989) the author has not seen Gyrinid beetles in temporary patches of water at Marsden Pt or in long-time permanent ponds further south at Ruakaka and Uretiti.

Incidentally, no Gyrinids have been found amongst pinned specimens of the E. Fairburn collection in the Northland Regional Museum, Whangarei, or in the E. Pritchard collection (AMNZ).

Sizes

The two specimens have been sexed and measured as follows.

Broun Collection (BMNH)	:	♀	4.8	mm
	:	♀	4.7	mm.

THE MANGONUI COUNTY POPULATION

In 1983 the present author found another population of *Gyrinus convexiusculus* in Mangonui Co. (Fig. 1) in the north of the North I (Wise 1983), more than 350 km from the area of the Waipa Co. lakes. This population has been monitored at irregular intervals until 1987 (Wise 1987) and again in 1988. It was still existing on 19 May 1989.

The northern locality

This locality for Gyrinids is on an exposed west coast low plateau south of Ahipara, a seaside area at the south end of Ninety Mile Beach, south-west of Kaitaia. The plateau, referred to here as Ahipara Plateau (known locally as "the gumlands"), lies south from Tauroa Pen. and in the north is faced by high sandhills which drop steeply to the sea beach. The plateau, itself, generally over 152 m (500 ft) high, extends to coastal cliffs further south and as far as steep cliffs overlooking the Herekino Harbour and is bounded inland by a narrow, steep-sided valley. It is dissected by stream valleys and is open rolling country ca. 183-244 m (ca. 600-800 ft) high in the north, more hilly to the south and east.

The site

The Gyrinid population occurs in open man-made ponds on the northern half of the Ahipara Plateau which was once covered by forests of kauri trees. Throughout the north, since last century, kauri gum has been collected from the ground previously occupied by such forests (Evans 1980, Hayward 1982). Gum-digging was a major occupation for large numbers of people, and trade and the economy were largely based on it. This trade continued into this century but has declined since the 1920s.

There was a surge of activity, however, in the early 1930s during the big economic depression when kauri gum digging was one of the many subsistence occupations which people took up at that time. Although in this particular area, where the Gyrinids were found, gum-digging was done last century, the peak activity was in the 1920s, when hundreds of gum-diggers were involved in sluicing the ground for gum (Hingley 1980, Hayward 1982:7,34). Long wooden aqueducts were built and ponds were dug for water storage prior to sluicing or washing. These ponds, contained by earth banks, were known as 'dams' and some isolated dams still exist although the banks do not dam running water. Three of them hold water all the year round, the water arising from rainfall and seepage, and it is in these that the Gyrinids occur.

All the information found by the author so far indicates that these particular dams were constructed no earlier than the 1920s and most probably in the early 1930s.

Dams

The first dam where Gyrinids were discovered is on a flat, open area surrounded by low tussock and scrub. This dam, known as Dam 1 (Figs. 2, 3), has open water with sedges in parts (vegetation had increased substantially in 1988). It is an elongate H-shape, each arm being at least 94 m long and the total area is ca. 1500 sq. m. The down-side bank is ca. 1 m high and the water depth is ca. 0.3-0.6 m deep.

Fig. 2. Dam 1. Northern arm looking inland.

Fig. 3. Dam 1. Southern arm looking towards coast.

The other two dams (known here as SE Dam and Hukatere Dam) are on sloping hillsides. Each has a downhill bank lying across the slope and being ca. 2 m high along its length. The water depth is greatest inside the bank and there is an area of sedges in the shallower uphill portion of the pond. Hukatere Dam (Figs. 4, 5) has an angled bank 77 m long which encloses a water area of ca. 800 sq. m, SE Dam is smaller.

Two of the dams are near each other and the third is ca. 2.5 km away.

Observations and collections (Tables 1, 2)

The area has been visited only from time to time as opportunity permitted but between February 1983 and January 1987 collections were made at least once in each month of the year so a composite picture could be built up in 1987. Further observations and collections were made every month from January to July 1988 and are included here. Most observations and collections were made in the northern arm of Dam 1 and all weather observations at one point on the northern side opposite the cross channel, ca. 216 m (ca. 710 ft) asl.

Weather

Weather observations were taken, as near as possible, at 12 noon Local time (New Zealand Standard Time) or Local Summer time (New Zealand Daylight Time). Whirling air temperatures ranged from 25.0°C (summer) to 14.5°C (winter). Water temperatures ranged from 24.0°C (summer) to 12.0°C (winter) during 1983-1987 and 28.0°C to 13.0°C in 1988. Winds, in general from 1983 to 1987, were northerly, mainly fresh to strong during spring to autumn and southerly, mainly light to fresh during winter. There were changes in winds during 1988. Cloud was mostly Cumulus throughout each year, often with rain clouds.

However, observation days were mostly finer days in order to see Gyrinid activity. Bad weather days were avoided so the weather observations do not indicate a complete range of conditions. Frequently the plateau is covered by low cloud and is subject to heavy rain showers.

Sightings

At first, observations of occurrences were noted only as few, several or many but later counts of numbers of whirligig betles seen from one place in 60 (or 30) seconds were taken. The beetles have been seen in each month of the year but counts have been missed for August, September and November.

Counts

Highest counts (in 60 seconds) for summer were December — 22, January — 57, February — 51 and March — 42, but there were also counts of 45 in May and 41 in July. However, there were differences not shown by the counts, such as the 45 in May 1984 which were in one group with few others seen, whereas in summer months there were many others visible in the dam as well as those counted at one spot.

Fig. 4. Hukatere dam looking southwards from middle of earth bank, with hillside behind.

Fig. 5. Hukatere dam, southern end.

Table 1. Observations of Gyrinid beetles in Dam 1 and weather, 1983-1988.

Date	Beetles Sighted	Counted No. per seconds	Collected ♂♂	Collected ♀♀	Weather Time*	Air temp. ca. 1m (whirling)	Water temp. ca. 15cm deep	Wind	Cloud†	Sun on site
16.II.1983	Few		1	3						
1.III.1983	Several		4	5						
2.III.1983	Few		1	1						
26.IV.1983	Several		6	2	1200L	20.5°C	17.0°C		10/10 As 3/10 Cu	
9.VIII.1983	Many		7	2						
10.VIII.1983	Many		1	—						
21.IX.1983	Several		6	3	1200L	17.0°C	17.0°C	NNW strong	8/10 As 5/10 straggly low Cu	
3.XI.1983	Many		9	10	1200LS (1100L)	20.0°C	20.0°C	NNW fresh	9/10 Sc straggly low Cu	
29.XI.1983	Several		3	2	1200LS (1100L)	19.0°C	20.0°C	SE —SSE fresh	4/10Cu	
30.XII.1983	Many in small groups	7/60 16/60 13/60 22/60	6	3	1200LS (1100L)	21.0°C	22.0°C	SE gusty fresh to light	1/10 Cu mostly on horizon, band to W over sea	Sun
1.II.1984	Many in groups	3/60 4/60 4/60 5/60 7/60 51/60	1	11	1200LS (1100L)			NE light	7/10 Cu	Sun
28.II.1984	Many — several groups over 50	20/30 49/30	16	36	1300LS (1200L)	25.0°C	23.0°C	NNE fresh	3/10 Cu	Sun
28.III.1984	Many in groups	11/60 30/60 42/60	10	17	1200L	21.0°C	21.0°C	NE fresh to strong	9/10 Cu Rain clouds about — slight shower	

Table 1. (Cont.)

Date	Beetles Sighted	Counted No. per seconds	Collected ♂♂	Collected ♀♀	Weather Time*	Air temp. ca. 1m (whirling)	Water temp. ca. 15cm deep	Wind	Cloud†	Sun on site
24.IV.1984	Several	6/60	4	—	1200L	19.5°C	18.0°C	NW light	1/10 Cu on horizon	Sun
		7/60								
29.V.1984	Few 1 group	45/60	2	4	1200L	15.0°C	13.5°C	S fresh	10/10 8/10 Cu + As	
26.VI.1984	Many	15/30	4	2	1200L	16.0°C	12.0°C	Var — S light airs	7/10 Cu	Sun
24.VII.1984	Many	41/60	4	7	1200L	14.5°C	14.0°C	S light to fresh	9/10 7/10 Cu + high Sc or Ac	
16.X.1986		11/60	2	3	1200L	18.0°C	19.0°C	NW fresh	9/10 Cu, Sc	
		6/60							Shower in ½ hour before	
2.I.1987	Many	30/60	24	20	1210LS (1110L)	21.5°C	23.0°C	ENE fresh	8/10 Cu	
		57/60								
					1310LS (1210L)	23.5°C	24.0°C	SE fresh	4/8 Cu 2/8 Ci	Sun
15.I.1988	Few		4	2	1300LS (1200L)	24.0°C	25.5°C	SE gusty fresh	8/10 Cu	
8.II.1988	Few	8/30	1	3	1300LS (1200L)	25.0°C	28.0°C	S light variable	4/10 Cu	Sun
26.III.1988	Few 1 group	28/30	3	3	1200L	22.0°C	20.0°C	S fresh	5/10 Cu + Ac	Sun
14.IV.1988	Several		2	5	1415L	17.0°C	18.0°C	NE very light	10/10 Overcast + Cu to N Lighter break to NE Light rain	
18.V.1988	Several	20/60	2	4	1204L	19.0°C	16.0°C	NW light variable	10/10 Cb	
28.VI.1988	Several	20/60	3	5	1200L	16.0°C	13.5°C	SW light variable	6/10 5/10 Cu 1/10 Ci to NW	Sun
19.VII.1988	Several		4	2	1200L	16.0°C	13.0°C	S light variable	4/10 3/10 Cu 1/10 Ci to N	Sun

*L - Local. N.Z. Standard Time. LS - Summer. N.Z. Daylight Time.

†Standard abbreviations: Cu-Cumulus, As-Altostratus, Sc-Stratocumulus, Ci-Cirrus, Cb-Cumulonimbus.

Table 2. Observations of Gyrinid beetles in hillside dams and weather, 1984-1987.

Date	Beetles Sighted	Counted No. per seconds	Collected ♂♂	Collected ♀♀	Weather Time*	Air temp. ca. 1m (whirling)	Water temp. ca. 15cm deep	Wind	Cloud†	Sun on site
HUKATERE DAM										
1.II.1984	Many		2	11						
1.III.1984	Few			4						
26.VI.1984	Few •		1							
2.I.1987	Many	55/60	5	6	1130LS (1030L)	23.0°C	20.5°C	NNE fresh	7/10 Cu	Partial sun
SE DAM										
24.IV.1984	Few									
26.VI.1984	Nil									
2.I.1987	20 in whole dam		1	4						

*L - Local. N.Z. Standard Time. LS - Summer. N.Z. Daylight Time.

†Standard abbreviations: Cu-Cumulus, As-Altostratus, Sc-Stratocumulus, Ci-Cirrus, Cb-Cumulonimbus.

Collections

Collecting was tentative at first as it was recognised that this could be a very fragile population. Later, after more beetles were found, collecting reflected the population to a degree as more were taken when more were present. Again in 1988, because of increased vegetation, the population in Dam 1 was considered to be threatened and collecting was reduced. Gyrinid beetles have been collected in each month of the year. Highest numbers taken were summer collections, January — 44, February — 52 and March — 27. In the remaining months less than 20 were taken in each month with the lowest numbers in winter and spring.

Although searched for many times by netting in the water and examining bottom and bank-side samples, only one immature was collected. This was a well-grown larva taken in the month of December.

Swarming

On two occasions a mass of active whirligig beetles was seen on the surface of the water. Each time, the occurence was in a small shallow "bay" at the end of a dam and the beetles were more or less packed against the shore where they caused a flurry of water.

On 1 February 1984, when Hukatere dam was found, numerous beetles in a mass were noted at the southerly end. On 28 February 1984, there were large numbers of very active beetles in both arms of Dam 1. In the southern arm there were several groups over 50 in the eastern end (sheltered from the easterly wind) and a large group noted as "probably several hundred" in a bay at the end.

The nature of these swarms was not discovered at the time. Amongst possibilities there are physical factors, such as wind (either wind-blown or wind-sheltered) or water temperatures, or behavioural factors such as taking advantage of a food supply or mating. Perhaps the last is most likely.

Sex ratio

All specimens of Gyrinid beetles taken have been sexed (by the form of the fore tarsi) and measured (except a very few which were damaged in some respect). Both sexes were present in every month.

In almost 300 specimens from Dam 1 the sex ratio was 45.3% males: 54.7% females. Monthly ratios varied considerably, sometimes more males than females sometimes less. One January collection was 24 males to 20 females and one February collection 16 males to 36 females.

Sizes

Measurements were taken on the mid line from the posterior end of the elytra to the anterior margin of the labrum, which may be more or less flexed. Even so, the measurements indicate that the northern New Zealand population is noticeably larger than the size range given by Ochs for *Gyrinus convexiusculus* which was 3.5 - 4.75 mm.

The overall size range of pinned specimens in the Dam 1 population is 4.2 - 5.2 mm.; specimens in alcohol can extend further. There is also a distinct bimodal range for the two sexes. Males measure 4.2 - 4.6 mm and females 4.7 - 5.2 mm, except for a female taken in April 1988 which is 4.6 mm.

The northern specimens overall are larger than the Waikato specimens (see above) which also show a bimodal range, males 4.3 - 4.5 mm and females 4.5 - 4.7 mm.

Identification

This Gyrinid traces to *Gyrinus convexiusculus* Macleay, 1871 in Ochs revision of the Australian Gyrinids but the size ranges given above indicate that individuals are distinctly larger, which may be due to food supply and/or climate.

Fauna

Whirligig beetles in the northern dams are part of a highly predatory population of aquatic insects. There are other aquatic beetles, dragonfly and damselfly nymphs, backswimmers and water boatmen. On the surface there are scavenging pond skaters and water measurers. A dense population of midge larvae in the bottom mud is presumably the main base of the food chain, and there are also other fly larvae, caddis and crustacea present.

Occurrence elsewhere

During the 1983-87 period, streams and temporary pools on the local plateau area were particularly searched for Gyrinids, as were accessible lakes and ponds to the north, without success. These easily seen whirligig beetles were also looked for during general aquatic insect collecting in the Mangonui Co. and in other places both north and south of Auckland.

It was not until 19 May 1988 that one male *Gyrinus convexiusculus* was seen and collected ca. 35 km north of the Ahipara Plateau site. This individual was in an artificial plastic-lined forestry pond which contained a small population of other aquatic insects. The pond appeared to have been constructed in recent years (beside an old abandoned pond) and is one of many in the extensive pine forest planted some thirty years ago. It had been examined for aquatics, by the author, several times since January, 1988. The whirligig beetle occurrence suggests recent local movement of the species but could be an influx from another area.

NOMENCLATURE

A taxonomic list of synonyms is given for *Gyrinus convexiusculus* by Ochs (1949), the list given here is of New Zealand related records.

This species was described from Australia by Macleay (1871). Specimens were also found by Hutton, in the Waikato, New Zealand, who recorded the species as the European *G. natator* (Hutton 1873). He apparently also sent a specimen to Pascoe who described it (1877:141 "My specimen has . . .") as *Gyrinus huttoni*. Broun (1880) recorded the species under Pascoe's name and quoted Pascoe's description and comments, as did Régimbart (1886). *Gyrinus huttoni* was subsequently listed by Severin (1889), Régimbart (1892, 1902) and Hutton (1904).

Under the heading of *Gyrinus natator*, which was the first name used for the species in New Zealand (Hutton 1873), Régimbart (1907:171) accepted advice received from G.J. Arrow and synonymised *G. huttoni* of New Zealand with *G. convexiusculus*, thus recording the latter in this country. Ahlwarth (1910) placed *G. huttoni* as a synonym of *Gyrinus convexiusculus* but did not record the latter from New Zealand. Ochs (1949) included the synonymy and recorded *G. convexiusculus* from Australia, New Zealand and elsewhere.

Tillyard (1926), Hudson (1934) and Wise (1965) still recorded the species in New Zealand as *G. huttoni*. Since then, records are of *G. convexiusculus* by Wise (1973, 1983, 1987), McLellan (1975), Anon. (1979), Winterbourn & Gregson (1981), Chapman (1982) and Helmore (1982), except for two of *Gyrinus* by Green, Chapman & Boubee (1979) and Green (1979).

Abbreviations for collections

BMNH (Broun)	Broun Collection in British Museum (Natural History), London.
BMNH (Ent)	Main Entomology Collection in British Museum (Natural History), London.
NMNZ	National Museum of New Zealand, Wellington.
NZAC	New Zealand Arthropod Collection, Entomology Division, D.S.I.R. Auckland.

In view of the extensive collections recorded above (Tables 1, 2) it is not felt necessary to record here the specimens held in the Auckland Museum collection. All those specimens have been collected and identified by the present author; some will be lodged in other collections.

In the following specimen data, separate labels are indicated (by a stop and space) wherever possible and numbers of specimens are given in brackets.

Genus *Gyrinus* Geoffroy in Müller, 1764

Gyrinus Geoffroy in Müller, 1764, Fauna Insectorum Fridrichsdalina, xvii.

Gyrinus convexiusculus Macleay, 1871

Gyrinus convexiusculus Macleay, 1871, Trans. Ent. Soc. N.S.W. 2 (2, 3):128.
Gyrinus natator: Hutton, 1873, Trans. Proc. N.Z. Inst. 5:246 (NZ).
Gyrinus huttoni: Pascoe, 1877, Ann. Mag. Nat. Hist. (4) 19:141 (NZ).
Gyrinus huttoni: Broun, 1880, Manual New Zealand Coleoptera, 76 (NZ).
Gyrinus huttoni: Régimbart, 1886, Ann. Soc. Ent. France (6) 6:257, 271 (NZ).
Gyrinus huttoni: Severin, 1889, Ann. Soc. Ent. Belgique 33: 164 (Waikato).
Gyrinus huttoni: Régimbart, 1892, Ann. Soc. Ent. France 60:745 (NZ).
Gyrinus huttoni: Régimbart, 1902, Genera Insectorum Fasc. 1:8 (NZ).
Gyrinus huttoni: Hutton, 1904, Index faunae Novae Zealandiae, 151 (NZ).
Gyrinus convexiusculus: Régimbart, 1907, Ann. Soc. Ent. France 76:169, 171 (NZ).
Gyrinus huttoni: Régimbart, 1907, Ann. Soc. Ent. France 76:169, 171 (as syn.).
Gyrinus convexiusculus: Ahlwarth, 1910, Coleopterorum Catalogus 4, Pars 21:18.
Gyrinus huttoni: Ahlwarth, 1910, Coleopterorum Catalogus 4, Pars 21:18 (as syn.).
Gyrinus huttoni: Tillyard, 1926, Insects Australia New Zealand, 194 (NZ).
Gyrinus huttoni: Hudson, 1934, New Zealand beetles and larvae, 43, 179 (NZ).
Gyrinus convexiusculus: Ochs, 1949, Rec. Aust. Mus. 22(2):172 (NZ).
Gyrinus huttoni: Ochs, 1949, Rec. Aust. Mus. 22(2):172 (as syn.).
Gyrinus huttoni: Wise, 1965, Pacific Insects 7 (2):213 (NZ).
Gyrinus convexiusculus: Wise, 1973, Rec. Auckland Inst. Mus. 10:145, 156 (NZ).
Gyrinus convexiusculus: McLellan, 1975, Biogeography Ecology New Zealand, 557 (NZ).
Gyrinus sp.: Green, Chapman & Boubee, 1979, N.Z. Lim. Soc. Newsl. No. 15:42 (NZ).
Gyrinus convexiusculus: Anon, 1979, N.Z. Lim. Soc. Newsl. No. 15:44 (NZ).
Gyrinus sp.: Green, 1979; N.Z. Lim. Soc. Newsl. No. 15:50 (NZ).
Gyrinus convexiusculus: Winterbourn & Gregson, 1981, Bull. Ent. Soc. N.Z. 5:39, 43 (NZ).
Gyrinus convexiusculus: Chapman, 1982, N.Z. Ent. 7 (3):285 (NZ).
Gyrinus convexiusculus: Helmore, 1982, Bull. Ent. Soc. N.Z. 8:46 (NZ).
Gyrinus convexiusculus: Wise, 1983, Rec. Auckland Inst. Mus. 20:256 (NZ).
Gyrinus convexiusculus: Wise, 1987, Int. Assoc. Lim. Abstr., 138 (NZ).

BMNH (Ent). New Zeal. Gyrinus huttoni. Type. Pascoe Coll. 93-60 (1).

This must be the holotype specimen of *Gyrinus huttoni* (by monotypy) as Pascoe (1877) referred to only one specimen received from Captain Hutton. The type label is printed on red card. The Pascoe Collection label indicates the specimen was received in the BMNH collections in 1893.

New Zealand Pascoe Coll. Gyrinus convexiusculus Mcl. (1).

This is another early specimen, probably also received by Pascoe from the same source as the type. It may have reached the BMNH collections later indirectly from another source.

BMNH (Broun). Marsden Point. Gyrinus huttoni. 142. New Zealand Broun Coll. Brit. Mus. 1922-482 (1). Marsden. 142. New Zealand Broun Coll. Brit. Mus. 1922-482 (1).

The two locality labels and one determination label on the two specimens are in the same handwriting, believed to be Broun's. "142" is Broun's species number for *Gyrinus huttoni*.

NZAC. Lake Maratoto nr. Hamilton, drainage channel, 20 May 1979, M.A. Lewis & T.K. Crosby NZWO. Gyrinus convexiusculus Macleay det. T.K. Crosby May 1979 (3).

A further label on one specimen indicates it as the one illustrated by D.W. Helmore, 5 Dec. 1979 (see Helmore 1982).

NMNZ. Maratoto outlet, 14.3.80 M.A. Chapman & J.A.T. Boubee. Gyrinus convexiusculus Macleay Det. R.G. Ordish (3).

DISCUSSION

The Waikato population, first discovered in the late 1860s, or early 1870s, may have continued to the present day in the peaty lakes which are in an area possibly not investigated for aquatic insects much since Hutton's time. Although numbers seen since the late 1970s are very low there could be a level sufficient to keep the population going, allowing for movement between several lakes close together. This seems to be more likely than re-infestation from somewhere else, particularly as Chapman (1982) mentioned 22 lakes in Waipa Co. and over 50 in the Waikato Valley.

The recently found specimens from Marsden Pt. have added another dimension to the consideration of distribution and origin of the species in New Zealand . They apparently represent a population there prior to 1919.

The Mangonui Co. population appears to have occupied the present dams only since the early 1930s but there may have been natural ponds on the Ahipara Plateau previously. Further north, the one specimen was in an artificial pond in an afforested area.

The recent finds of specimens from Marsden Pt. and an individual in the far north, in addition to the populations in the Waipa Co. lakes and the Ahipara Plateau ponds, do suggest greater movement of Gyrinids either to or within New Zealand than previously suspected. In considering the origin of the Gyrinid populations in three areas of northern New Zealand there are the possibilities of them being long-standing or arising more recently from Australia.

Although Ochs, in his revision of Australian Gyrinids (1949), acknowledged that *Gyrinus convexiusculus* is a widespread species which may have migrated from the north to Australia, he particularly stated that the species could not have travelled long distances over the ocean. He postulated the necessity for use of an early Tertiary land bridge for distribution of this species to New Zealand.

The other possibility is that Gyrinid populations could have originated from Australia more recently. It is well-known that Australian insects do get blown across the Tasman Sea and birds are either blown or actively migrate. The North Island of New Zealand is ideally situated for wind-borne insects to land. Or could a bird, such as a wading Heron, Egret, Ibis or Spoonbill, have carried the species across the Tasman?

Further, establishment of a species requires survival of the first progeny. Perhaps new artificial ponds provide a comparatively safe habitat before the build-up of a predatory fauna.

Acknowledgements. Mr Bill Carlin, Lands & Survey Dept., Auckland, introduced me to the Ahipara Plateau (15-18 February 1983) with the co-operation of Mr Noel Macelrheith (Senior Field Officer, Kaitaia) and Mr Pat McConnell (Ranger) who supplied continuing information over several years. Miss Judith V. Evans, Far North Regional Museum, Kaitaia, provided some historical information.

Assistance with information and access to specimens was received from Dr Laurence Mound (Keeper) and Dr Peter Hammond, and other staff, Dept. of Entomology, British Museum (Natural History), London, Dr Ann Chapman and Jacques Boubee, Dept. of Biological Sciences, University of Waikato, Hamilton, Dr Trevor Crosby, Entomology Division, DSIR, Auckland, and Mr Ron Ordish, Entomology Dept., National Museum of New Zealand, Wellington.

I should like to add that an error was made in my recent paper on tiger beetles (1988:178). In 1987, it was Dr Peter Hammond and other staff in the Coleoptera Section, British Museum (Natural History) Entomology, who assisted with access to the beetle collections and Dr Peter Barnard and other staff in the Neuroptera Section who gave access to Neuroptera and aquatic groups. In 1989, Dr Hammond and staff have kindly searched the T. Broun collection and sent the specimens found, on loan, at short notice.

Miss Rosemary Gilbert, Auckland Museum, has prepared Fig. 1 for publication.

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